

# Aviation Week

*and Space Technology*

75 Cents

A McGraw-Hill Publication

May 15, 1961

SPECIAL REPORT:

**Light Aircraft  
At British Show**

**General Electric Plug  
Nozzle Engine Firing**



## From Aerojet's LIQUID ROCKET PLANT

Propulsion for  
TITAN, DYNA-SOAR,  
ADVANCED PROJECTS

The slender TITAN I, shown here in its first stage-separation flight. The power plants: liquid-propellant rocket engines—designed, developed, and manufactured by Aerojet-General's Liquid Rocket Plant.

Supplier of engines for TITAN I and II, DYNA-SOAR, and ROMARD, the Liquid Rocket Plant is the nation's largest fully integrated facility for the research, development, and production of liquid rocket engines.

- In-Space Rocket Engines
- Large Boosters
- Pre-Packaged Liquid Rockets

## LIQUID ROCKET PLANT

**Aerojet-General**  
CORPORATION  
SACRAMENTO, CALIFORNIA



Engineers, scientists—investigate the leading opportunities of Aerojet



## space systems planning and engineering in a unique role

The scientists and engineers of Aerospace Corporation are in the forefront of advanced planning and general systems engineering. Their unique role—critical civilian link linking government and the space-industrial team—developing space systems and advanced ballistic missiles. In providing broad scientific and technical leadership to every element of this team, they are engaged in activities spanning the spectrum from formulating new weapons systems concepts to technical supervision of the over-all industry team performing research, development, and test of missile/space systems. Specific activities include: investigation of techniques for improving the state-of-the-art in propulsion, structures, guidance, communications and other engineering fields related to missile/space missions; feasibility studies of new weapons systems concepts and preliminary design of guidance systems; formulation of development programs; conduct of critical experiments; technical supervision of the development and test program. Men with these backgrounds are invited to write to Mr. George Herndon, Aerospace Corporation, Room 101, P. O. Box 95011, Los Angeles 45, California.

Oriented to the public interest and dedicated to providing objective leadership in the advancement and application of space science and technology for the United States Government

AEROSPACE CORPORATION



another  
advance  
in

vibration/shock/noise control



**BTR®**  
Elastomeric  
Mountings

**the answer to high reliability for sensitive instruments, guidance systems, electronic equipment**

**A**re you concerned with high reliability for equipment with low vibration/shock tolerance? Is your application on aircraft, missiles, space craft or ground support equipment?

Then here's the vibration isolator that gives you everything you need.

**Low BTR (Broad Temperature Range)** Elements: Mountings cushion high G shock loads, isolation to 2000 cps, give 88-attitude protection, limit resonant amplification to approximately three or less. And this performance is unaffected by extreme environments and temperatures from  $-52^{\circ}$  to  $+300^{\circ}$  F. Size for size, once for a while, they pack more load-carrying and over-temperature capacity than any other isolator.

Performance has been repeatedly proved on the most difficult applications. Even ultra-sensitive inertial guidance systems on operational ICBM's are now protected by standard production BTR Mountings.

Under the advance in vintropip/shock/acess control to achieve higher reliability for your project.

Information on BTR Electronic Mountings is contained in Bulletin 308, available from your nearest LOTO Field Engineering Office or the Home Office, Erie, Pa.

**LORD**

## FIELD TRAINING OFFICER

[illegible]

**LOBO MANUFACTURING COMPANY, INC. PA.**

## AVIATION CALENDAR

May 22-24—National Telecommunications Conference, Shattuck Tower Hotel, Chicago, Ill.  
 May 24-26—PASA National Symposium on Global Communications, Institute of Radio Engineers, New York, New York  
 May 25-27—Quarterly Conference, Society of Automotive Engineers' Military Group, Support Logistics Conference, Case Western Reserve University, Cleveland, Ohio  
 May 25-26—Symposium on Laser Capacity Memory Techniques for Computing Systems Information Systems Branch—Office of Naval Research, Washington, D. C.  
 May 25-27—"A Long-Range Conference and An Support Symposium, Washington  
 May 26-28—First National Conference on the Physical Form of Space, Tulsa, Oklahoma, NASS, Tulsa Chamber of Commerce  
 May 28-June 4-1984 Pacific International "A-Move, Be Moved" Fair, Seattle, Washington  
 May 29-June 1—National Flight Memorial, Clyde Hill, Dallas, Texas  
 May 31-June 2—University of Michigan's 25th Annual Radio Symposium, Ann Arbor, Michigan  
 June 2-3-11th National Management and Operations Meeting, Reading Airlines, Surrey, Eng., Reading, Pa.  
 June 3-4—National Association of National Safety Council, Protective Committees Meeting, Lambert Field, St. Louis, Mo.  
 June 4-6—International Instrumentation Systems Conference, University of Waterloo, Ontario, Canada  
 June 5-7—American Rural Youth Show, Toronto, Canada  
 June 6-14—Golden Anniversary of North American Pacific Film  
 June 13-15—National Maritime Conference, Seattle, Washington

(Continued on page 6)

## AVIATION WEEK and Space Technology

May 15, 1944  
Vol. 24, No. 20

It is difficult to write an additional line to the above, by which to distinguish between the two. The first is a simple, direct, and unambiguous statement of the author's intent. The second is a more complex, indirect, and ambiguous statement of the author's intent. The first is a simple, direct, and unambiguous statement of the author's intent. The second is a more complex, indirect, and ambiguous statement of the author's intent.

[illegible]

Under these legal provisions and change of ownership, Polymers, Morgan, Jackson Park, Ill., has been named the new firm. It is authorized to lease the Polymers-Morgan property and change its address, plant, etc., as long as the original agreement, which was entered into with Polymers, remains in force. There are no plans to change its location.

Footnote: From west to east is Portland, Ore., San Antonio, Wash. D.C., and Vancouver, B.C. The last three were Park II & III.

## THE CHERRYLOCK TEAM



**The Standard Cherrylock**  
Top Performance Through the  
entire range of Stomachs, Grips,  
and Materials.

**The Bulbed Cherrylock**  
Specifically for Thin Sheet and  
Double Dimple Applications—  
Even Greater Strength in the  
Short Grip Ranges

### Only the Cherrylock "2000" Team Gives you All These Advantages

- Mechanically Locked Stem
- Flush Fracture (No Start Bumping)
- Positive Clamp-up
- Full Grip Range
- Complete Hole Fill
- Positive Visual Inspection (Drip Marked on Head)

Адрес: Стамбул, Мост — Муради — Контракты

The Cherrylock® "2000" series team offers the finest, most adaptable strength results yet developed. Maximum joint strength and reliability are obtained by using the Standard Cherrylock and the Bulbed Cherrylock to cover the entire range of applications. The Bulbed Cherrylock for short graps and double dips, the Standard Cherrylock in the longer graps. Both types are installed with the same H-610 series pulling head, same amazing Cherry stain.

Higher joint strength allowed for, close blind side clearance, and the

Management Info. Systems 44

wider grip range available—only with the Cherrylock Team—result in better fastening at lower cost. The Cherrylock Team provides the strongest mechanical lock—flash fracture steel available. Positive visual inspection after installation—with grip length marked on the rest head—is offered only by the Cherrylock Team.

For technical data on the Cherrylock Team of rivets, write Cherry Rivet Division, Townsend Company, Box 2157-M, Santa Ana, Calif.

**CHERRY RIVET DIVISION**

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**Townsend Company**

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In Canada: Formstar & Lulworth Manufacturing Company, Limited, Bensenville, Ontario



Highest  
performance,  
smallest  
size...

**CEC's NEW  
HIGH-LINE,  
LOW-DIFFERENTIAL  
TRANSDUCER**

There's a port on each end of CMC's Type 4-451 Un-bonded Strain Gage Pressure Transducer—and both are suitable for corrosives liquid or gas media. This new instrument is an ideal high-line, low-differential transducer for use in orifice-plate flow meter applications.

The 4-551 is the smallest wrist of its type on the market and offers the highest performance of any comparable instrument. Look at some of its specs:

Differential pressure—range— $\pm 15$  psid through  $\pm 300$  psid, 10% overpressure.

Line pressure rating —  
5,000 psi.

Stability —  $\pm 50$  mv.  
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call your nearest GEC  
sales and service office or  
write for Bulletin GEC  
4842-X2

### Transmitter Division

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**A. J. Janssen et al.** / *Journal of Macroeconomics* 24 (2002) 341–360

## AVIATION CALENDAR

(Continued from page 5)

chair of the American Numismatic and American Book Society, Ambassador Hotel, Los Angeles, Calif.

June 15-15-17th Meeting American Distributors and Manufacturers Assn., Denver Hotel, Denver, Colo., U. S. A.

June 14-15—Fifth Annual Conference, Food and Engineering and Packaging, Institute of Food Engineers, Sheraton Hotel, Philadelphia, Pa.

June 1911—Space Flight and Re-entry  
Trustees Symposium, International  
Astronautical Federation's Deliberations

June 1921—Institute of Navigation—USNA  
Symposium on Superpowered Air Transport

June 12-13—Eighteenth Annual Symposium on  
Computing and Data Processing, Denver

June 16-18 - Fifth National Convention on

Military Electronics Institute of Radio Engineers, Shoreham Hotel, Washington  
 June 26-28—Compro Symposium on Space

June 26-30-Special Technical Conference,  
Institute of Physics at Imperial College

Admission: Adults \$4, children \$2.50. Includes  
round-trip transportation. Concessions. Free  
parking. Open 10 a.m. to 5 p.m. daily. 1000  
N. 1st St., Phoenix, Ariz. 85004. (602) 254-2222.

June 27-29—International Symposium on Analytical Advancements Santa Barbara, Calif. (Contact: Capt. J. L. Gilbert, Air Force Research Office-Durham, Durham, N.C.)

**June 18 M**—Joint Automatic Control Conference, University of Colorado, Boulder

June 21 July 1: Annual Meeting, Institute of Navigation, Williamsburg, Va., Williamsburg, Va.

**July 17-18:** Force Contract Aviation Systems Symposium, National Aeronautics and Space Admin., Hotel Washington, Wash., D.C.

July 1936—Air Traffic Control Facilities Symposium, Elmhurst Measuring Equipment Assn. Madison Hotel, Wash.

July 23-Aug. 30—International Trade Fair and Autumn Exhibition, McCormick

Aug. 13—Fourth Western Regional Meeting, American Astronomical Society, Sheraton Hotel, Chicago, Ill.

Aug. 79—Gardner and Neigamon Clarke  
over American Book Society, Stanford  
University, Palo Alto, Calif.

Aug. 12-13—Western Electronic Show and  
Convention, Cow Palace, San Francisco  
Sept. 4-10—1963 Flying Display and Exhibit

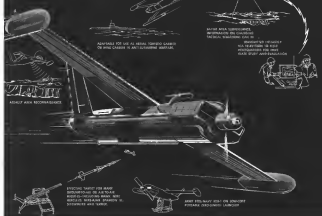
Sept. 6-8—National Symposium on Space

Electronics and Telephony, Institute of  
Radio Engineers, University of New  
Mexico, Albuquerque, N. M.  
Sept. 18, 1952, National Government, Mexico

Oct. 27-28th International Astronomical  
Congress, Washington, D. C.

Dec. 9-15—American Basket Society's 16th Annual Meeting & Spare Flight Report to the Nation, Columbia, New York, N. Y.

### SEEK "IMAGINITY" IN Wide Target Systems and Remote Control Aircraft



*Beech radio-controlled Army 1025 and Navy KDB-1...*

**Low-cost operational missile target of proven reliability, adaptable to many requirements**

Designed to meet advanced weapon systems training and evaluation requirements, the Beach Army 100/Naval KDD 1 has already demonstrated its versatility in a wide variety of missions. In addition, it can be easily adapted at low cost, to perform other missions in the fields of reconnaissance, ICBM and anti-submarine warfare. With a top speed of 300 knots, it can be at offshore in seven hours.

40,000 feet and can carry interior payloads of up to 250 pounds and up to 4 cubic feet.

Already operational and simple to use, the ECM/SL-2001 can be supplied rapidly to field commanders and can be operated by relatively untrained people. All equipment and tools required for ground support are fully developed, available and ready for use.

Beech Aerospace Division

BEECH AIRCRAFT CORPORATION • WICHITA, KANSAS

Test Manager Utilities actually helps fill in many of the critical gaps in the current test management applications. For example, the application is designed to help you create and manage test cases, test plans, test runs, test results, and test reports. It also helps you manage test cases and test plans. The application is designed to help you manage test cases and test plans. The application is designed to help you manage test cases and test plans.



Based on the B-57, T375 T-10 Hi-Loks are used to assemble the wing tips. These Hi-Loks have counter-rotating heads manufactured to extremely close tolerances. That counter-rotating shoulder spreads each tip as load sharing... in other areas of the wing and fuselage, Hi-Loks make it easy to size all members. And, Hi-Loks are used for strength, load-carrying, and resistance and weight saving features.

**hi-Lok**

## PROVIDES CONSISTENT PRELOAD IN ALL GRIP CONDITIONS...

The Air Force's Mach 2 B-58, produced by the Convair Division of General Dynamics, quickly maintains optimum performance and flexibility using a minimum weight and space structure. The Hi-Lok Fastener is highly suitable to this advanced structural design and is used in a variety of conditions.

Used primarily in shear applications, the Hi-Lok provides a predetermined clamp-up or ultimate tensile value which is highly consistent with all other Hi-Loks in the same joint. Unlike a swaged type fastener, the Hi-Lok retains the same consistent tensile value in all grip conditions, no matter through how many.

For open structural areas, Hi-Loks can be installed quickly by one man at rates up to 45 per minute using automatic installation tooling. In compressed areas, Hi-Lok can be used without risk of damage to the adjacent structure because Hi-Lok tooling engages the fastener away from the bearing face. Where return flanges restrict access, the Hi-Lok offset, 90° and extended tooling provide the necessary reach.

Hi-Lok tooling is simple and inexpensive. It is comprised of adapter tools fitted to standard, multi-purpose air driven wrench which may be found in any shop.



Contact your Engineering Standards Group (ESG) at the Convair Plant or write us directly for additional information on Hi-Loks.

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**Aeroquip**

**COUPLING DATA SHEET**

FOR NAME: **SHIPLE PROTECTIVE DIV. - HARTFORD**

FOR SIZE: **1/2"**

FOR TYPE: **1/2"**

FOR MATERIAL: **304**

FOR FINISH: **304**

FOR COLOR: **304**

FOR WEIGHT: **304**

FOR LENGTH: **304**

FOR DIRECTION OF FLOW: **304**

FOR PRESSURE: **304**

FOR TEMPERATURE: **304**

FOR VIBRATION: **304**

FOR SHOCK: **304**

FOR CYCLING: **304**

FOR CORROSION: **304**

FOR WEAR: **304**

FOR FATIGUE: **304**

FOR TENSILE: **304**

FOR COMPRESSIVE: **304**

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FOR WEAR: **304**

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FOR TENSILE: **304**

FOR COMPRESSIVE: **304**

FOR BENDING: **304**

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## Now! Connect or Disconnect at 4300 psi. with POSITIVE SAFETY

Developed especially for Honda Motor Division, the Aeroquip Quick Disconnect Coupling is used to change a waste pneumatic system. Aeroquip designed into the coupling a safety feature to permit quick, safe connection and disconnection under full system pressure. Other safety features include a residual pressure bleed system, device to prevent accidental removal of the fill valve from the changed tank and to prevent slipping of the hose if disconnected with the supply pressure on.

Honda reports a considerable increase in the safety factor, and that individuals using the coupling feel

more secure than with the previous fill unit.

The quick disconnect is just one of many designed by Aeroquip to solve special problems in aircraft, medical, ground support and offshore equipment. Aeroquip's total experience covers a wide range of fluids, temperatures, pressures, operating and performance characteristics.

Whatever your fluid line disconnect problem, Aeroquip can solve it quickly, most effectively. For helpful information, read this coupon below for your copy of the 8 page illustrated Bulletin 254, "Design Considerations for Special Quick Disconnect Couplings".

SEND THIS COUPON TO: Aeroquip Corporation

COUPLINGS FOR ALL TYPES OF FLUIDS

THREE TYPES

THAT CAN BE USED FOR ALL TYPES OF FLUIDS

SEND THIS COUPON TO: Aeroquip Corporation

**Aeroquip**

AEROQUIP CORPORATION, JACKSON, MISSISSIPPI

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Aeroquip Corporation, Jackson, Miss.

Please send me a copy of Bulletin No. 254

Name \_\_\_\_\_

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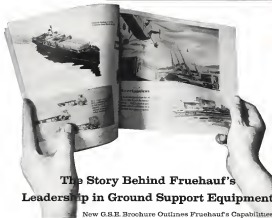
Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

What type of fluid line do you require? (check one)

☐ Air ☐ Oil ☐ Gas ☐ Hydraulic ☐ Other



## The Story Behind Fruehauf's Leadership in Ground Support Equipment

New G.S.E. Brochure Outlines Fruehauf's Capabilities



For a copy of this 3-color, illustrated brochure "Fruehauf G.S.E." write...

Fruehauf is the largest Ground Support Equipment specialist—with extensive design, research, development and production facilities devoted exclusively to your G. S. E. problems.

Fruehauf's coast-to-coast facilities are described in a new 20-page, 3-color brochure—"Fruehauf G. S. E."—just off the press.

- ... Two separate and complete divisions—Military Equipment Division, Detroit, and Missile Product Division, Los Angeles
- ... Over 2,400,000 square feet of manufacturing space available for your G. S. E. production
- ... 11 modern manufacturing plants spaced across America
- ... Over 70 factory-branches to efficiently serve both military and civilian needs
- ... Proven ability on a staggering number of prime and sub-contracts
- ... Over 45 years of design and engineering skill in the transportation industry.

Plants in the East and West

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## PDM PIONEER IN SPACE SIMULATION

### a primary source for COMPLETE ENVIRONMENTAL FACILITIES

- High Vacuum Experience
- Field Erected Systems
- Cryo-Panels and Refrigeration
- Diffusion Pumping
- Stainless, Aluminum and Alloy Fabrication
- Solar Simulation
- Dynamic Model Supports



#### FOR CHANCE VOUGHT DALLAS

This polished chamber of stainless steel for Chance Vought's earth simulation is 12 ft dia x 16 ft long. In service, pressure will be reduced to 1x10<sup>-7</sup> Torr Hg. or 1,100,000 ft. Lower photo shows mass spectrometer testing.



#### FOR GENERAL ELECTRIC VALLEY FORGE

The largest high vacuum chamber now under construction—32 ft dia x 94 ft high. Designed for ultimate 10<sup>-8</sup> service, this chamber has a polished stainless steel interior. Pump ports are equipped with PDM designed liquid nitrogen cooled elbows. The vessel contract includes a pumping system designed and furnished by Consolidated Vacuum Corporation.

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**PITTSBURGH-DES MOINES STEEL COMPANY**

GENERAL OFFICES: Neville Island, Pittsburgh 25, Pennsylvania • FT. Dear 1, 3000 • District Offices in Principal Cities

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CAN **BONDING**  
DO IT **BETTER** FOR YOU?

**IN A RAPIDLY INCREASING NUMBER OF MANUFACTURING OPERATIONS, THE ANSWER IS YES...** Bonding can do a better job and can do it at less cost! Rohr is a pioneer in adhesive bonded metal techniques and structures and is preparing this specialized capability to the solution of many new manufacturing problems.

**MISSILE AIRFRAMES AND ROCKET SECTIONS**, such as this Rohr built missile fin, can be made better and faster with bonded structures. More strength/weight ratios, cleaner aerodynamic surfaces, better structural integrity for exposure to toxic vibration and long standby periods, lower tooling and production costs... Just a few of the superior qualities of bonding.

**RADAR REFLECTORS AND ANTENNAS** are among the precision products made better by bonding. The other method provides such dimensional stability and accuracy, plus light weight and fine surface finish.

**HELICOPTER BLADES**, too, can be made from new bonding methods and materials developed by Rohr. The blade section illustrated is made with see-perforated honeycomb core... a technique which is also ideal for aircraft control surfaces.

These examples are but a few of the many ways that metal bonding is doing a better job. For more information about this, or other Rohr capabilities, write Mr. A. R. Samuels, Sales Manager, Department 40, Rohr Aircraft Corporation, Ohio Wells, California.

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ADHESIVE TECHNOLOGY

PLANT AND HEADQUARTERS: OHIO WELLS, OHIO  
REGIONAL OFFICE: JOHNS-MANVILLE, NEW YORK, NEW YORK

Insulation News from Johns-Manville

## Min-K® soars through space—and back!

**J-M INSULATION WITH MIN-K  
LOWERS THAN THE MOLECULAR  
CONDUCTION OF AIR, SHIELDS  
AGAINST EXTREMES OF  
HEAT AND COLD**

As the Mercury Space Craft is launched, orbit is and is recovered, exterior temperatures range from around -100°F to plus 1500°F. Yet, only inches away, inside the space vehicle, temperatures never fall below or exceed comfort and health levels. The reason? Two Johns-Manville innovations, selected by the Donald Aircraft Corporation and the NARA, are doing their job to perfection. They are the only thermal insulations used in the space craft.

One of these is Min-K, the super insulator for critical areas. This unique material exhibits a marked reduction of thermal conductivity as atmospheric pressure decreases. Min-K also possesses a thermal diffusivity lower than ordinary materials which weigh five times as much. Thus, it is possible to control thermal transients at a fraction of such volume.

For other sections of the Mercury Craft, where controlled heat flow was necessary, J-M Thermaflex RP-163 was used. Together, the Johns-Manville insulations make up a team that helps solve the space craft problem.

Solving insulation problems is a Johns-Manville specialty. For assistance on your problems, details on Min-K and other J-M aviation insulations, write J. B. John, Vice-President, Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable address: Johnsmanv.

**JOHNS-MANVILLE**



# NEW ANSCO-TAINER!

Gives you complete safety  
in storing and transporting X-ray  
films *plus these important extras:*

1. Lightweight—strength without bulk.
2. Light-tight—completely light sealed.
3. Superior construction—protects film against artifacts.
4. Durable—Long-lasting plastic finish resistant to stains.
5. Perfect size—carries just the right amount of film needed to do the job. Will hold a 15 sheet interlinear or 150 sheet non-interlinear. Pouchpak from a Suprapak or Bidelpak® carton.
6. Economy—costs far less than expensive suitcase containers.
7. Easier darkness handling—opens and closes with ease to dark.

But the new ANSCO-TAINER has to be seen to be appreciated! Handsome, versatile, the perfect darkness-dispersible-area X-ray film carrier. Pack it, peek it up and go... no fiddly cases when bulk is necessary. As protective and as safe for your film, as the darkness itself! ANSCO, Burlington, New York, A Division of General Aniline & Film Corporation.

AnSCO  
X-ray



Versatile—the AnSCO-TAINER is the right size for most jobs. Holds a complete Pouchpak from a Suprapak or Bidelpak® carton.

A few checks or a single sheet... complete safety for exposed or unexposed film, with all the convenience of fast portability.



You could wade thru all this...



Or let us mail you this!

It tells you what aluminum equipment is up for defense bids.

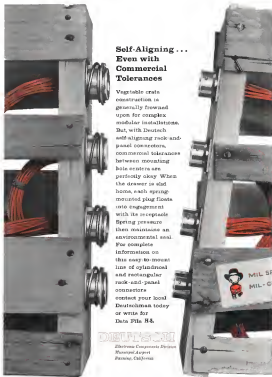
Kaiser Aluminum's weekly Sales Lead Bulletins are the only comprehensive source that alerts you to upcoming defense projects involving aluminum. ■ These bulletins are an exclusive highlight of Kaiser Aluminum's Defense Marketing Service. This unique service also offers you invaluable assistance in diversifying to other markets, military or commercial. ■ In addition, you can rely on our nationwide staff for: (1) basic assistance in preparing defense bids, (2) recommendations for alloys and

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See us today at the Aluminum Institute





## Self-Aligning... Even with Commercial Tolerances

Vegetable crate construction is generally frowned upon for complex modular installations. But, with Deutsch self-aligning rack-and-panel connectors, commercial tolerances between mounting hole centers are perfectly okay. When the drawer is slid home, each spring-mounted plug floats into engagement with its receptacle. Spring pressure then maintains an environmental seal. For complete information on this easy-to-mount line of cylindrical and rectangular rack-and-panel connectors, contact your local Deutschman today or write for Data File H-8.

**DEUTSCHMAN**

Electronic Components Division  
Microdot Airport  
Pasadena, California

ADVANCED SPECIFICATION MINIATURE ELECTRICAL CONNECTORS

(Microdot)

## Airborne DC Amplifier



Small, solid state, direct-coupled DC amplifier weighs only six ounces. Less than five cubic inches in volume, this rugged, hermetically sealed instrument is available with solder, plug-in, cone or combination header arrangements and a variety of coverings. DC gain is 200 to 2000  $\pm 0.75\%$ . Input capability is 5 milli-volts differential at maximum gain; output capability is  $\pm 5$  volts into not less than 20K (single-ended).

Microdot Inc., 229 Pasadena Avenue, South Pasadena, California

## Temperature Transducer



Small probe-type device for high and low temperature applications where high pressure and severe flow conditions are required. Precise liquid or gaseous measurements to 800°F. Top sensing element of deposited platinum film allows high base resistance, extreme linearity, wide range capability, and fast response. Approved for ICBM environments.

Microdot Inc., 229 Pasadena Avenue, South Pasadena, California.

## VHF-UHF TRANSMITTERS



Proven in history's most demanding environment—outer space—the custom designed unit shown above is typical of the development skill and production capability available from Microdot. The unit shown is miniaturized, pressurized, and features a solid state power supply that cannot be damaged by input/output overloads. Units are available in a complete range of modulations—CW, FM, Phase, and Pulse, with frequency coverage 100 to 2000 mc/s and output from 100 mw to 10 watts.

Telemetry capabilities at Microdot have been dramatically expanded with the recent acquisition of Spectroscan Instrument Company. The highly trained development skill, production capability, and working experience of Spectroscan in the field of VHF and UHF omniwave and related instrumentation is available from Microdot's Instrumentation Division. This equipment, concentrating its attention to mission mission and support, is a vital part of each important project as Pioneer V, Jupiter, Atlas, Freedom, Redstone and Saturn.

**UHF Telemetry Transmitters**, Models 2108 and 2420, use a unique automatically stabilized circuit, with the output frequency referenced directly to a quartz crystal. This approach allows a greatly reduced cost compared to the multiplier chain traditionally required to achieve crystal stability, as well as increased reliability due to a fewer number of parts.

The transmitters have their own solid state power supply designed to provide a high ratio of rf output power to total power input. The frequency modulation circuit is sufficiently linear to reproduce completely reproducible distortion to the modulation signal. For further information, call Microdot or write for catalog sheet TT-5.

### SPECIFICATIONS

Frequency Range	220-2000 mc/s
Mod. PWR.	1425-1250 mc/s
Mod. PWR.	1-500 mc/s
Frequency Stability	$\pm 0.001\%$
Power Output	10 watts
Power Supply	10 vdc
Modulation	10 vdc
Temp. Voltage	PCW/TM, PAM/TM, FM, 10
Temperature Range	$-40^{\circ}\text{C}$ to $+70^{\circ}\text{C}$
Modulation	10 $\pm$ 5000 cps
Size	3 1/2" x 7 1/4" x 1 1/2"
Weight	22 pounds

## MICRODOT INC.

229 PASADENA AVENUE, S. W. PASADENA, CALIF.  
MICRODOT 2-1111 500-0000 1-1171





**MR the moving target sooner!** Make the missile fly faster. Increase payloads, increase range, decrease missile size! ■ These urgent demands call for more push per pound of solid propellant—and per dollar. And squeezing more and more energy out of fuels is a big part of our solid work at OCR. Recent examples: Nitroplastol—new double-base composite type propellant. Immediate application: Army's new Mauler mobile ground-to-air missile. Future uses: high mass-ratio upper-stage motors, small ICBM, ejection motors, orbit and retro motors, and many more. **GRAND CENTRAL ROCKET COMPANY**  
ROSELAND, CALIFORNIA



**FASTER  
FASTER  
FASTER!**

## EDITORIAL

### MR-3 in Perspective

Looking back on the successful voyage of Astronaut Alan Shepard in the Mercury capsule atop the Red-streak booster, it is obvious that this is one of the best things that has happened to this country in many years. The MR-3 space shot must be viewed in its proper technical perspective as an early phase test of the equipment and men who have embarked on the tremendous task of exploring space. But it must also be viewed in the proper psychological and political perspective of these troubled times.

MR-3 was a great engineering triumph with every system, subsystem, valve, relay, circuit and switch working well and perfectly in a fabulous sequence that matched performance with predictions so closely that it is surprising it is hard to distinguish between them.

It was also a great triumph for the astronauts who had the courage to volunteer for this necessary step in the exploration of the unknown, and the determination to stick with their chosen task despite all the early problems and disheartening experiences that are inevitably a part of any basic new exploration.

#### Impact on America

But most important perhaps than these aspects was the impact of MR-3 on the American people, their political leaders and on American prestige around the world.

• **First, it helped crystallize a decision already in its formative stages within the top levels of the Kennedy Administration to get into the space race in earnest, and position the goal of achieving international prominence in space as a first national purpose.** The public manifestation of this decision, reinforced in large measure by the demonstration of MR-3, will be fundamental in the next few weeks as more money is added to both civil and military space programs and the President himself positions our firm national purpose to catch and surpass the Soviet Union in this vital area.

• **Second, it proved to the rest of the world that this nation was not to be discouraged by its steady entry into space, nor by the early successes of the Soviets.** It proved that we have the will, technical skill and determination to stay in this race until the full course is run and that we will not quit after a few desultory laps and let the launch gap in the Soviet Union by default.

• **Third, it provided one of the most dramatic contrasts between the open freedom of this country and the repressive secrecy of the Soviet Union** that has reverberated around the world and reflected enormous credit on our way of living. It demonstrated to billions of people all around the globe far more clearly than anything we have done in recent years just what our concept of freedom really is and how it works in our own land.

• **Fourth, it provided a badly needed sense of pride for us at home, raising as it did after a long stretch of discouraging news going all the way back to Sputnik I.** It made millions of Americans feel proud that we are still producing, pioneers such as Edw. Shepard and his fellow astronauts, and the thousands of technicians who are supporting their effort in the design, fabrication and operation of their space exploration vehicles.

#### Blood, Sweat, Money

The success of MR-3, however, should not blind either the American people or their leaders to the long, hard road that lies ahead both in our own steps toward outer space and in our newly found determination to lead the world in this endeavor. This road will be paved with spectacular failures that will extract a high price in blood, sweat and money and we shall have to pay it in the full glare of worldwide publicity without wincing in our purpose to achieve the ultimate and resolvable success we seek.

Despite the success of MR-3, we are still in a long stern chase with the Soviets in space. It is evident from the details of the Soviet's Vostok space day that they have considerable lead not only in the field of boosters big enough to hurl heavy payloads into orbit but also in the biotechniques systems required for long space voyages. This vital area of biotechnology is another case where the full technical resources already available in this country have not been properly harnessed nor addressed to the space task ahead.

#### Spectacular Proof

The initial space voyages of May Gagarin and Edw. Shepard have proved in spectacular fashion that man not only can survive in space but can work under the conditions imposed by spaceflight. These performances should permanently shut the scientific conservatives who have consistently scorned the possibility of man functioning usefully in space and have tried, almost too successfully, to label as wasteful both the Mercury man-in-space program and its proposed follow-ons such as Apollo.

We must be motivated to the bottom making longer and more complicated manned space voyages than our Mercury program can ever produce, but we must not lose this new-found determination to pursue the space race with all of the technical resources at our disposal as a basic national purpose. For not only will our achievements in this area serve as an international demonstration of our will, skill and determination but they will produce so extensive technical aid that they will better our best experiments in the life of mankind all over this tiny planet.

—Robert Hertz



## TI's RADAR CAPABILITY...



For systems requirements, Texas Instruments now offers major advancements in microwave techniques resulting from 10 years' experience in the development and production of radar equipment. Significant technological advancements include computer-aided improvements through the following:

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2. Pre-selector filters—screen out extraneous noise from other radars.
3. Solid-state microwave oscillators—used as local oscillators or parametric amplifier pump sources—these devices are crystal-controlled for high stability and can be used in any application requiring a stable, reliable signal source.

Examples of TI radar systems operational today include the following:

4. Brevet Radar system for the U. S. Army Signal Corps AN/VSQ-3 combat drone, produced by Fairchild.
5. ASU/APQ-85 reconnaissance radar in the U. S. Army Bureau Corps L-28 aircraft.
6. AN/APR-49 radar and APA-128A indicator in U. S. Navy T-30B ASW patrol aircraft.
7. Engagement displays for Nike-Zeus—the U. S. Army's anti-ICBM defense system, produced by Western Electric Company.
8. ASB-4 radar for Federal Aviation Agency controls on port traffic in congested areas. Display remote gives clear indication of moving targets.
9. ASB-4 equipment also acts as target system's design—all components uncovered for easy servicing.

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## WHO'S WHERE

### In the Front Office

Dr. R. Paul Siegel, a director, the Hughes Corp., Redwood City, Calif., is a graduate of this office. University of Maryland.

Bernie Foster, president, Aero Composites, Inc., Berkeley, Calif. Mr. Foster is currently vice president of Rockwell-Standard Corp., the parent company.

J. J. Roberts, associate vice president, Autonics International, a division of North American Aviation, Inc., Chicago, Ill. Cold also W. E. Siegel, now president-plus very Dr. W. R. P. Roberts, currently the president/technical planning. Autonics International has formed an new division and made the following appointments: Compact Section—Dr. A. E. H. Holbrook, manager and manager, and Ralph Robert, associate manager, Power Systems—Dr. Holbrook, manager, president and manager, Autonics Inc.

H. F. Kane, director, General Development—Dr. Henry Friedman, manager, Autonics International—W. E. Siegel, acting manager, General Services—R. E. Holbrook, manager.

Eric Woodard Jr., vice president, military contracts, Bell Helicopter Co., Ft. Worth, Tex. W. R. Siegel, vice president, operations, Autonics International, Co., San Diego, Calif., and H. L. Funt, vice president, manufacturing.

Thomas Allison, vice president, corporate planning, General Corp., Miami, Fla. J. David H. Baker, a vice president of Vickers, Inc., Detroit, Mich., and general manager of the company's International Division. Mr. Baker is currently president of Capital Airlines, currently R. E. Funt, acting.

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## INDUSTRY OBSERVER

▲Air Force has a testable payload payload program scheduled for 22 Air Force flights, with the first that planned this week from Cape Canaveral, says an Air Force official. The payload will be used later in the year. Payloads, some carrying in it subjects, will be started to industry, universities and other government agencies. Military and Air Force Special Weapons Center have instruments in the last payload.

▲Systems improvements for a second generation Nike Zeus anti-ICBM system, to be called Zenon, are under study by Army Ordnance Corps.

▲Lockheed is studying an Agena C upper stage rocket that could be used, potentially with the Atlas booster, to put 2,500 lb. into a 5,500-mi orbit in 1,800 to 2,200 sec. Agena C would have twice the capability of Agena B, probably achieved by doubling the Agena B tank volume. No development has been funded.

▲Canada may be considering the turbo-powered Kanan ASW, entry helicopter to be searched in an intermediate stage aircraft, using an ASW package with greater detection range than the AQ-32 equipped the U. S. Navy will try with the HUEY. The helicopter would operate from a platform on the stern of a Canadian destroyer escort. Tests with other helicopters have convinced Canada they can be used in the North Atlantic with 50-kt. ceiling, 50-ft. visibility conditions.

▲Ford & Whipple has successfully fired the LR-115 oxygen-hydrogen engine 75 times since test stands were separated after two exposures (ENR Apr. 24, p. 27). Two primary engine changes are an increase in the injector diameter for more and stabilization of an short stroke. Some is a wire in the exhaust stream which may burn through within a specific period or die repair a short time.

▲Seipens, manager, fired with implanted business industry equipment, is scheduled to be searched in July or in August of this year from Cape Canaveral. It will be carried payload in a screwable pod. North American Aviation is preparing manuals for the Air Force Systems Command equipment, and Space Labs, Inc. developed the telemetry system.

▲NASA's second nuclear engine engine vehicle is scheduled to be launched from Ft. Meade, Md., in October, using Aerobics Development's Agena D-3 booster. Four Navy shots were planned originally, but two Agena D-3 vehicles were diverted to the agency's Wildlife Station for other tests.

▲American Maritime & Boundary's Greenough, Conn., Engineering Division is performing analysis and engineering services for redesign of launch pad 20 at Cape Canaveral, Fla., to handle the Boeing Delta-Star boost phase Modification in the pad, which now handles the Atlas Titan I and will be used to launch the Titan II to boost Dyna-Soar, may require a new gassy at a cost of approximately \$2.5 million.

▲Proposals will be submitted July 10 under field Army ballistic missile defense system feasibility studies which are under study by Army Research and General Mobile Agency.

▲Ford & Whipple proposed a feasibility study of a high pressure oxygen-hydrogen rocket engine (ENR) in response to an Air Force Systems Command request which followed several unclassified requests to NASA and USAF (ENR May 20, p. 50). Advantage cited for the engine is that it would enable a single stage vehicle to boost a payload into a 160-mi orbit.

▲North Dakota only working satellite development shot will carry some equipment and test in radar flights and will be launched by a modified and improved Atlas.

▲Northrop-NASA Division has proposed development of an adapter to provide launch services for the National Aeronautics and Space Administration's Mercury manned space capsule. Proposed structure is a cone prop-boosted feasibility study.

(Continued on page 135)

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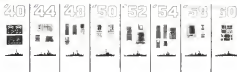
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## Washington Roundup

### Space Scrutiny

President Kennedy's request for more space funds (see p. 24) will set off renewed Congress-National Aeronautics and Space Administration and elements of Defense Department. The House Science and Astronautics Committee is expected to be the first to conduct such a review—probably a week after the President submits his money request.

Dispute between the Air Force and the Navy as to whether the U. S. should reach toward land or sea missile launching bases also is expected to surface in House space committee hearings. USAF would like land bases in equatorial countries in the corner of missiles do not have to be changed on the way to some targets. Navy contends that launching from ships is from sea platforms makes more sense. The committee will try to bring the viewpoint who favor it however the equatorial nations are not for the work.

An eight-weeked experience of the government's indirect policy on commercial communications satellites has been made by the Justice Department. It advised the Federal Communications Commission that work that it believes such a system should not be owned or controlled by a single private organization, regardless of the extent to which the organization might be subject to government regulation.

Justice said all interested commercial carriers should have an opportunity to participate in system ownership and to have unrestricted, non-exclusive use of such a system. Aerospace products of communications satellites also should be given a chance to participate in ownership, but this should not be a requirement for them to bid on satellite contracts.

### Goldberg's Tightrope

Labor Secretary Arthur J. Goldberg is walking a tightrope in his effort to administer labor peace at a time when the U. S. is in a state of high tension. He is McGeehan and others in Congress who are ready to pass for out-of-control legislation. On the other are labor chiefs who supported President Kennedy's campaign and charge that McGeehan's hearings have been unfair to them.

Goldberg, who has been successful in making decisions, is holding daily meetings today to persuade all parties that the President will not make any compromise to keep the strike program running smoothly. He is ready to make a pledge to labor to go along to strike disputes without strikes, and opposition by the President of a strike panel to take over when negotiations fail.

Atomic energy program has such a panel, headed by former Federal Reserve Chairman—now of the men Goldberg is consulting. The Congress panel makes recommendations for settlement after regular efforts fail. This month public opinion is the deciding factor.

Goldberg will oppose no-strike legislation. He feels strikes are a legitimate economic weapon at defense plants as well as elsewhere.

Defense Secretary Robert McNamara, who has been a popular witness on Capitol Hill, has had to feel rebuff from Congress. When he learned that armed services committees intended to put money for research into the budget, he made a special trip to the Hill to explain, but had no luck. One committee added \$177 million, the other added \$255 million (see p. 17).

### Information Flow

A free flow of information from the government was two difficulties last week, in spite of early indications that the President might hold the flow and continued evidence that Secretary McNamara felt the U. S. goes away for too much time (see p. 18).

President Kennedy met with editors and publishers to discuss his earlier request for "unclassified" and space voluntary cooperation from the press, and apparently reversed his former stand, indicating there is no need for action at this time.

He also indicated remarks made at a press conference after Assistant Alan Shepard's successful flight that put the U. S. in the position of keeping its press doors open to public view in spite of the bad propaganda effect that labor could bring.

Shortly before Shepard's flight, a number of the President's top political and scientific advisers exerted extreme pressure on him to postpone the shot until the U. S. position in international politics was stronger, or at least to close the shot in the press. Others ruled their careers to fight this point of view, and the gambler—including President Kennedy—won handsomely.

Two others under the Air Force deputy chief of staff for plans and programs are being disbanded after coming under Administration fire for opposing proposed defense policy changes. Brig. Gen. Noel F. Povich, assistant to the chief of staff, will become director of the Research Activities Institute of the Air University and Brig. Gen. Robert C. Richardson will become deputy director of the Military Activities Division, U. S. European Command in Paris.

—Washington Staff











# Soviet Lead Indicated in Bioastronautics

Washington—Soviet Russia apparently has a lead over the U.S. in bioastronautics that can be coupled with her longstanding advantage in pursuit of a long-term orbital flight: entering the earth at any time.

Decried reports on the flight of Miss Gagarin (U.S. Age 17, p. 24) in the past the belief of some U.S. aerospace medical experts that Russia has done far more to explore space medicine and to develop equipment and techniques for the support of life in space than this country has.

Russia's advantage does not come solely from the ability to put man weight in orbit in the opinion of these observers. It comes in a direct result of greater activity expended on the bioastronautics—with extra room and weight allowance in rocket and satellite payloads merely supplying a better tool with which to do the research. Other U.S. experts deny this, holding the view that weight is Russia's only advantage in this area.

Soviet press and radio records of the preparation for Gagarin's flight and its execution in the weeks following the orbital announcement have attempted to clarify the apparent discrepancies in the such reports, but without admitting that there were discrepancies.

These reports also reveal that:  
 • The time span of the test period for Gagarin's flight can support human life for as long as 10 days. By contrast the U.S. Mercury capsule is designed to support life for 24 hr. (Indication of the weight of the oxygen bottles for this approach.) Mercury's rocket is a considerable weight load, four man and was one of the toughest subsonic push into a capsule development. Obviously, the Mercury program anticipated 24 hr. flights with a life support system that was good for 40 hrs in case of emergency. Increasing oxygen capacity to the level needed for a 45 hr flight was a more exacting challenge, weight somewhere due to the capsule.

The U.S. has no fully developed closed-cycle, in representative oxygen system in the one used in Gagarin's "Vostok" spacecraft.

Even if Russia altered the subcarrier of two that was once recommended for the Mercury life system, it apparently could fly a manned space ship for five days. Description of Vostok state that "the reserves of food, water, seawater, batteries and the capacity of the electrical power source are calculated for a flight lasting up to 10 days."

Prolonged effects on man of weightlessness and the relative isolation in such a long flight are not known. But

the reports on Vostok point out that Russia proved that the orbital flight of the dog Laika in Sputnik II, then said a half year ago that "long periods of weightlessness per se do not disrupt the main processes of vital activity."

• Sputniks II and III may have carried living organisms, although Russia did not say so when they were launched. Discarding biographical research, the Vostok reports note that "biological experiments were continued on earth Soviet artificial satellites. Soviet experts refer to satellites launched prior to Sputnik IV as "orbital earth satellites," and to the six 4-ton objects that began with Sputnik IV as "satellites through Vostok as "spacecraft satellites." All six of these latter vehicles carried samples of animal and plant life, but until now there has been no discussion in life on the earth satellites other than Laika's.

• Atmospheric pressure and concentration of oxygen in Vostok apparently were maintained at or near sea level values, much more desirable situation than the 100% oxygen concentration and 5.5 psi pressure provided by the Mercury capsule—presumably for prolonged flights. The U.S. chose this pressure concentration balance for Mercury because of weight limitations. The concentration could be used for as long a flight as 24 hr., but not enough to

know about the prolonged effects of these abnormal conditions in such a long mission as those for several days. Follow-on vehicles such as Apollo will have weight allowance high enough to permit giving the man something more closer to his normal environment to work in.

Whether the only Russian advantage in its Vostok oxygen regeneration and pressurization system lies in the extra weight allowance is disputed in this country. Some bioastronautics specialists believe the Russians can claim a 10-day capability for oxygen regeneration because they are using superoxide than only—what the U.S. has explored but not perfected—to remove moisture and carbon dioxide from the cabin air. The superoxide has a greater capability for removing water from the air and liberating oxygen from them than the oxides used so far in this country.

Other experts believe that the information available that Russia's spacecraft are no further ahead in understanding long-life regenerative systems than the U.S. There seems to be little doubt, however, that the Russians already have fully developed such systems and are using them, whereas the U.S. has not because it does not yet have a vehicle in which to use them.

• Two methods of landing were used before the Vostok flight and Gagarin could have used either. Landing in the extra portion of the spaceship, using both a liquid braking engine and parachutes as Gagarin did, was noted with Sputnik IX and X-15. Merit. These two flights covered distances as the astronaut's chair as well as a capsule in the cabin. Gagarin also could have come himself and his coach from the cabin after it touched an altitude of about 4 m and landed by parachute. Reports do not make clear whether Gagarin would tell him of the coach, but they do say that when he was tested "before launch of spacecraft"—presumably Sputnik V, Vostok, which two days were completed with in a brief capsule and recovered last August, landing near 6 m near from the main body of the spacecraft.

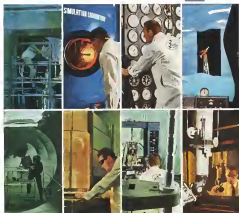
• Although provision is made for slowing the reentry by deceleration, it is designed to avoid direct caused by sudden deceleration in the atmosphere in case the braking and fails.

Soviet reports describe conditions inside the cabin as normal pressure and concentration of oxygen, carbon dioxide, concentration of no more than 1.0%, temperature range of 60 to 78°F, and relative humidity of 50 to 70%.

Representing nature is noticeable Oshkoff reference in the regenerating



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### GE Target Contract

Washington—ICBM target area errors for testing the Army Nike Zeus test battery missile system will be decreased and speeded by General Electric, Westinghouse and Space Vehicle Department under a \$40-million Air Force contract.

General Electric will supply 40 target simulators, including a range of target simulators to simulate the different enemy goals, including decoys, a defense missile is expected to meet (U.S. Age, p. 28). These designs will be built in the next months which finally probably have in the Mark II vehicle the GE group produced for Atlas and Titan models. The target vehicles will still carry two defense interceptors.

Targets will be fired from Vandenberg Air Force Base, Calif., and the Pacific coast to be intercepted by Nike Zeus test vehicles fired from Kwajalein Island in a series of tests scheduled to begin in January. Army has bought several Atlas to launch the targets, and others will be flown by Atlas and Titan as part of Strategic Air Command's random launch training program. Air Force Ballistic Systems Division will manage the target vehicle development program.



out where  
"hard over"  
won't help a bit...  
... out where activation of a control  
surface accomplishes nothing, only the  
total loss of motion can provide  
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agency is that they are "highly active chemical compounds." Too high a concentration of carbon dioxide causes a special transmitter to send a signal which in turn causes the "sustaining mechanism" to adjust the levels of the atmosphere. The mechanism adjusts automatically if excessive oxygen is absorbed. Humidity is regulated by the same way, and "special filter ports" are for measuring harmful impurities that are drawn off by the human organism and by the machinery.

That was regulated by a thermal protective layer on the outside of the capsule, a solar heat exchanger covering a system of shunters on the outer surface, and an automatic electrostatic latent system inside whose distinctive feature, according to the Russian aspect, is "a liquid cooling agent." The agent flows from the heat-regulating system into a liquid generator in a solar filter of air through the radiator is controlled automatically within the escape apparatus, depending on the temperature, the reports are sent.

Corrected figures concerning the Vostok flight give its weight as 10,395 lb instead of the 10,410.01 lb announced initially. Fenger now is given as 117.47 m instead of 118.76 m, and speed is 283.2 m instead of 337.65. Inclination is given as 68 deg. 37 min instead of 64 deg. 4 min.

Breakdowns in the life of Gagarin's flight and he had reported by radio to be low over South America at 9:22 a.m. Moscow time. Since this was only 15 min. after he was supposed to have been launched, the apparent discrepancy was widely commented on. The Inter reports used reference to flat terrain over and over 3-11 m in the first specific time reference after launch.

This was the time at which the solar orientation system was switched on as the spacecraft emerged from the earth's shadow. One side of the ship was aligned with the sun by means of optical and gyroscope instruments which sent signals to an automatic unit which in turn sent commands to various steering devices. At 9:52 he was firing in the area of Cape Horn—where the earlier reports had placed him at 9:22.

Gagarin's position was indicated by a globe whose rotation was synchronized with the movement of the ship. For manual control in case of emergency, Gagarin had an optical indicator mounted on one of the perches. It consisted of two circular mirror reflectors, a light filter and a globe with a grid—appearing a picture.

If the craft was correctly oriented, he saw the image of the horizon "in the form of a ring in the field of vision." He could determine orientation of the longitudinal axis by observing the "true" of the craft's surface and could turn the ship as such a way that "the

hazards here could be seen in the mirror later in the form of a concentric ring, and the direction of "roll" of the earth's surface would coincide with the mirror face at the grid."

Gagarin was mentioned by two tele-

vision cameras—now showing in full face and one by profile. The radio-teletype station had a magnetic recorder in its present taping his speech in flight and transmitting it when he was over ground stations.

## Successful MR-3 Flight Handled By Government-Industry Team

Washington — Government-industry teams which handled the successful flight of the MR-3, Sheppard, Jr., in the Mexican-Radiation capsule May 5, consisted of several thousand contractors and suppliers plus elements of the National Aeronautics and Space Administration, the Defense Department, the Weather Bureau and other government departments.

Robert R. Gilchrist manages the program as director of NASA's Space Task Group. STG reports to Dr. Abe Silverstein, director of NASA Space Flight Programs. The Agency's chief of manned space flight programs, George M. Low, has been the major congressional spokesman for Mercury.

### STG Members

Members of Gilchrist's organization primarily responsible for the first manned helioflight flight include Monroe A. Faget, who originated and defined the Mercury concept, including basic vehicle design; Walter C. Williams, who directs Mercury flight operations; Charles W. Matheis, who conceived the operational flight procedures; Charles F. Johnson, who directed the program during the early development cycle of the program, who is now assistant director of Langley Research Center; James Chamberlain, who acts as chief engineer for capsule quality control (USAF Lt. Col. William White, who developed the mechanical operational procedures; G. Marvin Preston, responsible for capsule preflight checks; and Dr. George Cooper, and Christopher C. Kraft, flight director in charge of the control center.

McDonnell Aircraft Corp. directs the efforts of more than 1,000 subcontractors in producing NASA's capsule and tractor. Management responsibilities in the company were with Walter Burke, vice-president for Project Mercury, and John Yandier, director of Mercury operations at Cincinnati.

Major subcontractors for the capsule are:

- Airframe stabilization and control, Monrovia-Hawthorne's Motion Products Corp.
- Rocket control, Bell Aerospace.
- Life support and environmental control, Garrett Corp.'s Aircrafts Verna Lufaxing Device.

- Parachute recovery, Northrup Corp.'s Redwing Division.
- Camera system, D. B. Midgley Co.
- Communications, D. V. Bell.
- Recovery and emergency, Collins Radio Co.
- Penoscope, Perkin-Elmer Corp.

Capable of operating in conditions of extreme weather, the MR-3, which is a capsule of America, consisted with the capsule (designed by Hanes Stiller Co., a division of Union Carbide Corp. Mercury-Radiation capsule) is now scheduled to be the first test of the MR-3 mission by the Redwing Division.

Sheppard's full personnel will be made by B. F. Goodrich Co.

Part of the Mercury-Skylark IIUS helicopter which reported Sheppard and his other flight was Lt. Wayne Koon. Lt. George Cox, engineer, appeared in the cockpit and looked the capsule.

Mercury later was commanded by Rear Adm. F. V. H. Miller from the control center, with Rear Adm. C. P. Koch commanding the recovery area task force from the USS Lake Champlain. Navy units were on destination-type ships, two coast guard cutters, and other ships. The Lockheed P-1V, and the Marine helicopters in the Lake Champlain. Air Force had tested two German Sky-5000 aircraft.

### Range Support

Range support included Air Force, Pan American and Radio Corp. of America personnel and facilities, command in the Gulf, Robert S. McInerney, deputy commander for range, Atlantic Missile Range.

Dr. Kurt Debus of NASA's Launch Operations Directorate, headed the Redwing vehicle launch team. The booster system, a modified version of the Army's tactical field missile, was developed by a team headed by Dr. Wernher von Braun at NASA's Marshall Space Flight Center in Huntsville, Ala. Dr. J. P. Koster is the Mercury project chief there.

Radiation 75,000 lb thrust engine is produced by Rocketdyne Division of North American Aviation Inc. and Chrysler Corp. manufacturers the booster system. Ford Instrument Co. manufactures the major portion of the Radiation control system.

## Escape Velocity Capability Doubtful For Air-Breathing Orbiting Vehicle

Washington—Air-breathing orbital vehicles cannot attain sufficient velocity to escape from the earth's gravitation and perform a space mission, according to Dr. Theodore von Kármán.

Dr. von Kármán believes propulsion other than liquid hydrogen liquid oxygen will be needed to achieve a relatively speed from 25,000 to 30,000 mph required for escape.

He indicated that some form of nuclear or radioisotopic power will have to be employed. He also predicted that electromagnetic phenomena eventually will be used in space propulsion systems.

At Fort Detrick, Office of Scientific Research and Development, Dr. von Kármán, an acknowledged pioneer who currently is chairman of North

Atlantic Treaty Organization's Advisory Group for Aeronautical Research and Development.

Dr. von Kármán was one of the early proponents of an air-breathing orbital vehicle, which the Air Force last sponsored in track form first as Space Plane, and later as Aerospace Plane (AW Det 31, p. 26).

Several companies are undertaking their own air-breathing studies. The named space vehicle is a necessity, he said. "I do not believe in an autonomous pilot. Decisions will always have to be made by a man," he added.

Dr. von Kármán, whose technical air division since the early 1930s, considers the development of supersonic flight as the greatest advance leading to further developments whose potential has yet to be realized, especially in global transportation.

"When the Wright brothers flew, and they are usually also thought that a great invention would come from it," he said. "Likewise, space flight will become an industry. Not that you will want to spend a lifetime on the moon, but incredible effort will support it."

### Weapon Vulnerability

Commenting on the mobility or vulnerability of weapons systems, Dr. von Kármán said that space, particularly in the case of an extension of the mobility of earth-based systems. He believes that weapons based on nuclear cars are vulnerable and also believes that the future submarine-launched missile is vulnerable in sea and that anti-aircraft warfare research will make Polaris less useful in the future.

Dr. von Kármán, whose technical air division since the early 1930s, considers the development of supersonic flight as the greatest advance leading to further developments whose potential has yet to be realized, especially in global transportation.



Powered by four Turbofans Turco IED turboprops delivering 1,218 hp each, Breguet 941 STOL prototype rolls out of factory in prototype for initial flight at Paris air show opening May 16. Type 941 can retract airframe principle to achieve STOL capability. Aircraft has a 150-mph cruise, climbing speed of 215 mph. Pressurized passenger version, the 942, will carry 45 passengers (AW News 14 p. 61).

## Breguet Readies STOL 941, Atlantic 1150 for Flight

Breguet 1150 Atlantic amphibious transport aircraft, jointly financed by the NATO countries (AW Jan. 25, 1964, p. 11), is scheduled to make its first flight in October. Two prototypes are under construction in Breguet's main plant in Toulouse. Aircraft will be powered by two Rolls-Royce Tyne turboprops and gross 56,000 lb. Span is 124 ft, length 50 ft, and wing area is 1,230 sq ft. Plane is a amphibious, land-based aircraft carrying a crew of 17. Cruising speed of the aircraft is estimated at 575 mph (AW Feb. 9, 1964, p. 11D).



## News Flow 'Shocks' McNamara; He Will 'Re-educate' Contractors

Washington—Defense Secretary Robert S. McNamara is "shocked" at the volume of "security" information that has been released in the past week with strong support and backing from Senate Armed Services Committee, he intends to do the door.

In testimony to the committee, he leveled his quest. McNamara described the "last objective" of his program as "the reduction of the volume of information that is of benefit to our potential enemies." Explaining various difficulties, he said:

"I start this program with a tremendous history of already released information—usually coming, one way or another, from the press. It is not very dangerous, but that space defense systems will have to be developed and then can be done in three to five years. A crash program can produce them in that period, he said.

"To change 15 years of procedures and to close the doors to the press overnight is impossible. You cannot do that. So we have to make an effort in gradually and intelligently."

McNamara added that to do the job he has assigned Lt. Gen. Joseph E. Carroll, Air Force inspector general, who is presently working within 12 ft of my desk, and working full time on it until we hopefully develop an efficient program.

The assignment of Gen. Carroll is understood to have been triggered by an Air Force "leak" of information that Secretary of State Dean Rusk advocated stronger conventional military forces to reduce reliance on nuclear strategic weapons. The General's appointment is understood to be a result of a sharp criticism in defense intelligence. As general news, McNamara stressed this in a letter to Ray, John White (D-Calif.) chairman of the House Government Information Subcommittee.

Apparently referring to the Rusk episode, McNamara told the committee: "I have already moved in that area, and there will be no more information on that area."

McNamara explained: "I propose to move rather slowly in this field. Instead of a direct attack."

Sen. Richard Russell (D-Ga.), the committee chairman, told McNamara "do not be frightened" by an old "war" and "voluntarily" to take the door of the Senate" and support McNamara's program.

McNamara declined to discuss reports on weapons capabilities.

"Why should we tell Russia that the Zeno developments may not be satisfactory?" he asked.

"What we might be saying is that we have the most precise and accurate system that the human mind will ever devise. Instead the public doesn't see already full of statements that the Zeno was not so satisfactory that it has deficiencies. (Security director) I think, it is absurd to believe that kind of information is the public."

McNamara and he is "shocked" not because the Pentagon's Security Review Office may be more to become a "leak" to the press. In one instance, he said, it was right at hand at night when he obtained a direct contact of his congressional testimony for public release. Even at that time, he said, "there was still so much in it that I sent a book. I cut out a lot of material and sent it back."

"This said, it is a lot to read it, but for review and eliminate this because it has already been made public, and it has been made public also not as a secret." But he said he was not sure place so we started that night eliminating."

McNamara related another incident in which he had been in a meeting of an unidentified major general for stating the operational date of a new weapon in a press dispatch.

But I found out that the general had not said anything," McNamara said. "In the first place, his speech had been cleared by the security office involved. In the second place, he was simply repeating information that had been released last July by another Defense Department spokesman, and it was not the spokesman's fault. It is the fault of the rules and procedures that we have."

### Soviet Record Chimps

Russia is showing steadily stable record of 112,235 ft in the final of an Aug. 25 flight of the Red Bull, which was 8,646, believed to be the Red Bull, and a record record of 448 mph for propeller-driven aircraft, based on a short record made by a helicopter. An 804, 41.5, holds current record of 101,191 ft. It is on USN/USN/USN F-304C, and 410,990 mph, set by North American F-31. Soviet has never documented records shown for the 8,646 Red Bull. According to International Federation of Aeronautical Engineers, the Red Bull record will be made in the close next month at the Paris Air Show.

Telephone and Telegraph Laboratories and Bell Laboratories Spelling Co. Final selection of telecommunications will be made later.

Army has decided to use the French Army developed Rantz and tank engine system. Model and launch weight 17 lb, and made in one controlled. Engine will replace the Ford 36 18.

While Soviet 1-ton-plus engine, carrying a 98 lb. recoverable capsule and scheduled to reach 990-mph altitude and travel 1,190 mi. down the Atlantic Missile Range last week, versus after 75 sec of flight and second stage ignition, requiring destruction by the range safety.

Now set a manned balloon altitude record at 113,000 ft. May 4 in a two-man, open cockpit stratosphere flight, which is the first of the Red Bull. Lt. Col. Victor A. Purdie, Red Bull's official observer, directed when he stepped from a helicopter basket as he was being lifted from the ground. Previous record of 102,160 ft was set by Air Force Maj. David G. Sasser in 1957.

El Al Israel Airlines has ordered two 7200 turbofan jets at a cost of \$14 million each. The order is subject to a 100,000 lb. weight limit. Delivery is scheduled for early 1965.

First B-52H was delivered to 379th Strategic Wing, SAC, Wurtsmith AFB, Mich., May 9, by Boeing-Westinghouse. Six B-52Hs are scheduled to receive the 767W TB-15 turbofan-powered version of the Stratofortress.

Kanawha Aircraft Corp. has established Kanawha Aerospace in a new division to become the State of Connecticut's aerospace research and development field, between Springfield and Hartford.

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# British United Airways Places First Order

By Herbert J. Coleman

London—First firm order for British Aircraft Corp.'s BAC 111 short-haul transport was placed last week by British United Airways, the United Kingdom's largest independent airline, which is applying for a lease to start 24 seats now held by Britain's ten state-owned airlines. British Overseas Airways Corp. and British European Airways.

British United has contacted to buy the BAC 111 in an initial order of 522-400,300 and has an option on 50 more airplanes. First deliveries will be made in the fall of 1968. Aircraft will replace 11 Viscounts.

In addition, a strong order sheet by BAC in the U.S. has resulted in a letter of intent to order four BAC 111s by Delta Air Lines, and "considerable interest" by Continental Airlines to replace its Viscount 740s. A Costa Central transportation company has also said it will support the airplane lease and will make a decision within 90 days, according to Sir George Edwards, BAC executive director (aircraft).

Sir George added that production is now under way on the last batch of 20 airplanes with unit costs set at about \$7.5 million per airplane. Discounting production costs, Sir George said that the government "is prepared to contribute to the launching cost of the project" noting that he did not know its extent and couldn't say if he did.

The BAC 111 is a large revision of the Blanking 107, now in jet-powered form two years ago and bears the same general configuration. Sir George said its configuration has proved there is a market for the 111 in a higher, more expensive aircraft than the 107, and that the corporation would proceed with this version subsequent to BAC 111 production.

Major differences in the new production. The BAC 111 will have two Rolls-Royce Spey 383-15 turbofans at about 9,500 lb thrust each while the BAC 107 will be powered with two Bristol Siddeley 86-7 turbofans of 7,150 lb thrust each. A British Airways team recently considered a variant of the 107, no decision has been made.

Designed to operate at a lower cost level than the Viscount, the BAC 111 will fly at a normal cruising altitude between 70,000 and 70,000 ft and will require no more than 4,500 ft to take off at its maximum weight under standard conditions at sea level. To further reduce the aircraft's direct operating costs, the transport also will have an

aircraft power unit, eliminating the need for expensive ground equipment for taxiing, idling, starting and warming the scheduled "cold-start" time, BAC said.

Direct operating cost analysis of the BAC 111 shows that the aircraft is cheaper to operate on a plane route basis than the Viscount 850 on stage lengths beyond 200 mi. The test program shows about 10 cents a mile, BAC said and as a range as low as 108 mi, the BAC 111 has a direct operating cost of about \$1.50 a plane mile.

Direct unit cost analysis of the aircraft on a 74 seat configuration, derived from 2.6 cents at 108 mi to 3.4 cents at 750 mi range, based on U.S. rates and Air Transport Association assumptions, BAC estimates that on the 69-seat configuration, the transport's unit mile cost would be reduced another 17%.

Short-range passengers had won't fly the 111 because with indirect routes equaling direct costs and based on maximum of seven seats a passenger mile, would be 15 passengers at 200 mi range, 22 at 400 mi, 22 at 600 mi, and 21 at 800 mi. The path the airlines had been before 107 at all ranges above 200 mi, BAC said.

Moreover, cost is being made in the BAC 111 of the detailed engineering

and process knowledge which has gone into the civil aircraft already produced by BAC companies which includes BAC 107, Avionics, English Electric, Vickers and Hunting. Among these technologies are the use of Viscount and VC 10 jet-powered models machined from solid metal and a fast-track design philosophy providing for deployment of more components than that of a conventional aircraft will not be disturbed, the company said.

The British United order is the second major one by a British company to enter the plane at BAC. Canadair last week signed a \$15.5 million order, including options with the Boeing Co. for two "70-400 jet transports (400-400) for use in the London-New York route, the order is less applied.

The application is being reviewed by BAC in its attempt to set for the week. Canadair, which also is an existing partner of the Viscount VC 10, and the Boeing order is not yet signed, an ordering of the North Atlantic route the airline has taken an option on a third 707 with the first two delivered early in 1967.

BAC's sales for the BAC 111 is not confirmed on approval of its bid on route capacity in the European market, according to E. A. Laker, the airline's executive director. He stated that British United needs the BAC 111 to "replace its existing Viscount" and that the airline will supplement the order if it gets a feasible decision from the Air Licensing Board.

British United previously had chosen approval of the de Havilland DH 121 Trident three-engine jet, but Laker said that the airline will supplement the order if it gets a feasible decision from the Air Licensing Board.

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# For BAC 111

passenger and arriving with adequate ground fuel. Laker said the BAC 111 fits this requirement. Malta was admitted to the operation last month. BUA considers it the most difficult airport in Europe for operating conditions.

British United would use the BAC 111 on all the European routes except services it has requested plus seasonal holiday ones. The airline has applied for its routes to Africa and the Far East but Laker said large jets would be needed for these. British United has shown some interest in the Viscount VC 10 but Laker emphasized that no decision has yet been made in regard to this aircraft.

BAC has formed a U.S. company, British Aircraft Corp. (USA), to promote both its military and civil product lines.

President of the U.S. corporation will be Christopher Chisham, formerly U.S. representative for the Viscount VC 10. W. M. White, former vice president of Western Airways, has been named executive vice president.

Other officers include Air Marshall W. C. Sherr, director of military roles, W. M. Sherr, manager of pass and public relations, Frank C. Hynes, director of technical sales, and Fred R. Child, secretary and treasurer. Headquarters of the new company will be in Arlington, Va., a Washington suburb.

Operationally, the BAC 111 will carry 57 seated class passengers and baggage at 600 mph. The wings of 600 mi with a two-blade fuel system. On medium loads it will carry 45 passengers for 2,200 mi non-stop, about equal to the Viscount 850. For that length, the BAC 111 can carry up to 60 passengers for 450 mi, up to 100 passengers or 57 passengers and 2,000 lb of freight. Best speed for economy and range will be 500 mph.

All design and manufacture of the 111 will be spread within BAC's aircraft group. Blanking Aircraft will build the wing, air sections will be completed by Bristol Aircraft, and fuselage and tail assembly will be done by Viscount Airways at its Blane plant near Birmingham.

The BAC 111 team now is working on a follow-on study of stage lengths past the 1,000-mile mark.

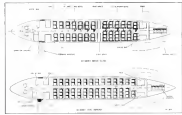
The BAC 111 is 93 ft 6 in long, with a wingspan of 54 ft 6 in and a wing area of 950 sq ft. Tailset height is 66,000 lb and maximum payload is 14,000 lb. The aircraft carries 15,000 lb of fuel and has a 500 hp ft. freight volume. Its Spey engine is a turbofan derived from the Siddeley 86-7 and has been running since December, 1960. Specific fuel consumption is 0.775 lb/hp at 25,000 ft.



BRITISH AIRCRAFT CORP.'S BAC 111 twin-engine transport depicted in drawing above will have a maximum capacity of 59 passengers and will cruise at 540 mph.



THREE-VIEW DRAWING shows position of Rolls-Royce Spey 383-15 turbofans (3,800 lb thrust) relative to low wing. Note nacelle in drawing below.



# Consolidations May Follow Varig Purchase

By Givco Corbin

New York—Purchase by Varig Airlines of 10% of the voting stock in Aerolineas Brasileiras may be a step toward the consolidation of Brazil's three as-trustee carriers within a year or two, according to Varig president Rubens M. Berto.

The purchase, which is being approved by the government, involves stockholdings owned by Varig and Real-Aerovias of a board of directors and a new president in control of Aerovias. The latter airline now is Brazil's international division, with routes from Brazil to Mexico, to Los Angeles and to Tokyo. Varig operates between New York, Rio and Buenos Aires and from New York to the Caribbean and Brazil.

Third international airline is FAPSA do Brasil, in which Pan American holds controlling interest. Panair flies to Rio and the Middle East. Berto stressed to Avianews Week reports that Varig interests are negotiating to buy major control of Panair from Pan Am. He predicted that the Brazilian government would handle any such transaction.

Varig does not intend to "pick the bill" for buying Panair, Berto said. But he forecast that there would be a single Brazilian flag carrier within one or two years.

The Varig/Real agreement is expected to create government sanction without delay, because Berto's son, president, Jairo Quadros was instrumental in bringing about a consolidation. Quadros has expressed the objective of consolidating the commercial carriers as a move to strengthening of the country's economy and modernizing criteria of responsibilities for aircraft and equipment.

According to Berto, it is also Quadros' intention to make Panair a Brazilian-controlled carrier.

Varig now operates three Boeing 747-400s and two Conquestors, Panair has two Douglas DC-8s, and Real Aerovias 900s are scheduled for delivery to Real Aerovias. Under the agreement, the 790 jets will be assigned to routes of the new jointly controlled Aerovias.

Berto, who purchased jets in South America with the Conquestors, said the long-range plan is to order all piston equipment and convert the three to jets to align Varig's only regret concerning the Conquestors purchase, he said, is that "we didn't have enough," and there are tentative plans to test four more.

Berto acknowledges that there was apprehension of some interference as

ports to Varig as the agreement. Varig has been making money on its international routes—about \$1.5 million last year, according to its president—while Aerovias has been losing money.

But the combined operation can be profitable, Berto said. If properly carried out, it should prove to be a good plan. He noted that President Quadros left the operation entirely in private enterprise, avoiding the possibility of nationalizing the Brazilian international air service.

The "united movement" under the agreement also should result in a favorable development in domestic operations, according to Berto. This would be complicated by reducing inefficient

competition and domestic routes by more agreements among the carriers.

Under the presently proposed agreement, Varig, Panair and Real will be added to the new board of directors, and a neutral president chosen, a man from another airline.

Aerovias, Varig and Real are having \$175 each of Aerovias stock, the other 10% being now sitting in preferred stock.

Price of the purchase has been reported at about \$1.2 million but Berto would not comment upon the accuracy of that figure. Since sources set the price high, the purchase is expected.

Delivery of the 990s is expected next January. They are destined for the Aerovias route to Los Angeles and Tokyo, now being served by Lockheed 1049H Conquestors. The 1049Hs, however, probably will be withdrawn in the meantime and replaced with leased Douglas DC-8s, although as more economic for the service than the turbo-propelled 1049H.

## Ruote Revisions

Regarding Aerovias' route to Miami, plans will be set for serving some routes. Instead of serving Miami via the east coast of South America, Aerovias would fly to a west coast route. Varig serves the east coast, and the change would be most "into the scheme of things," Berto said.

Aerovias had been making a Rio-New York route, but Quadros cancelled the airline's connection for the route. It would have meant direct competition between Aerovias and Varig.

Aerovias is trying to sell its last 1049H Conquestors. Eventually plans would be to retire Varig's five Super C Conquestors and Panair's four DC-7Cs and go to jets.

Berto said a possible first of cars refers to short hauls and Banguinhos DC-8s and 990s for the long hauls.

## Convair 880M Flight

### Tested at Edwards

Convair 880M jet transport made a helicopter ship, 1,900 ft., after crossing the 1041 electric point and landed during Convair and FAA tests at Edwards AFB, Calif. At 175,000 ft., stall speed was demonstrated at 9 ft./sec. 10 ft. improvement is a result of high lift devices.

The landing and takeoff tests recently began as part of the certification program which is expected to result in certification by late July. Other flight tests have been made since Apr. 29.

# BULLETIN:

## AeroShell Oil W becomes first fully compounded additive oil to win approval of every major aircraft piston engine manufacturer in the U.S.

Aircraft, large and small, have burned millions of flight hours on Shell's new additive oil—the first fully compounded additive oil approved by every major U.S. manufacturer of aircraft piston engines.

Here are answers to 10 key questions about AeroShell® Oil W—how it helps keep engines cleaner, reduces wear—even extends periods between engine overhauls.

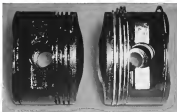
1. What types of aircraft can use AeroShell Oil W? Piston engine planes of any size. Helicopters, too.

2. Why is it called a nonwash dispersant oil? Because it contains special metal-free additives that help keep tiny, suspended particles in the oil from clumping together and forming deposits. These particles remain suspended and dispersed.

3. How does this oil affect engine performance? It meets fuel engine parts any cleaner. That lubrication points get all the oil they need. Your engine can run more efficiently, parts can last longer.

4. What about oil consumption? Because AeroShell Oil W helps provide a cleaner engine and less wear, you can expect less oil consumption.

5. Can AeroShell Oil W reduce maintenance costs? If you have been using a straight mineral oil, AeroShell Oil W can reduce your maintenance costs substantially. Intervals between



Left: Piston from engine using straight mineral oil after 1,000 hours, more dirty and older. Right: Piston from same aircraft after 1,000 hours on AeroShell Oil W.

engine overhauls can be extended.

6. How does this new oil respond from a cold start? AeroShell Oil W has an unusually high viscosity index. This guards against excessive thickening of the oil when cold, yet provides proper lubrication when hot. Results easier starting, faster warm up.

7. Is AeroShell Oil W thoroughly proved? Thoroughly. It's had millions of engine hours of flight time.

8. Can AeroShell Oil W be added as a make-up oil? Yes. It's compatible with all piston engine oils now being used.

9. Is there more than one viscosity grade? AeroShell Oil W is available in three viscosity grades: 100 and 120 grades for large engines. And 80

grade for small engines where straight mineral oil grades 55, 65, or 80 are usually recommended.

10. Where is it available? At Shell Aviation Dealers everywhere. Any dealer will stock AeroShell Oil W if you ask him.

Technical bulletin on AeroShell Oil W will be sent at your request. Write: AeroShell Oil Company, 50 West 53rd St., New York 20, N. Y.



A BULLETIN FROM SHELL—where 1,307 scientists are helping to produce better products for industry.



Decide where and when you want to go. The Lockheed JetStar, world's fastest business plane, takes you there with jetliner speed, comfort and reliability. Because it operates from fields of less than 5,000 feet, it can fly direct to hundreds more airports than the big jets—and make better point-to-point time. Four Pratt & Whitney Aircraft JT-12 turbojet engines power the JetStar. Each weighs but 436 pounds yet develops 8,000 pounds thrust. This high thrust-to-weight ratio contributes to the JetStar's short field take-off, its jet-performance climb, and its cruise speed of 500 to 550 miles per hour at up to 45,000 feet. The JT-12's simple, rugged design assures high reliability and easy maintenance. And it is backed by Pratt & Whitney Aircraft's worldwide service.



**Pratt & Whitney Aircraft**  
Division of UNITED AIRCRAFT CORPORATION

ENT HARTFORD, CONNECTICUT

## Short Designs Swing Nose SC.5 Freighter

London—Short Brothers & Harland has designed a swing nose and version of the Short SC.5 turboprop freighter and ferry, on the basis of studies, to sell it for intermediate loads of mixed passengers and freight.

The SC.5 freighter currently is being built for Royal Air Force, which has ordered 10. First flight will be early in 1962.

H. G. Conway, Short Brothers' design managing director, said here that the craft requires a double-deck, at least at loading up to 100,000 lb. of payload necessary between New York and London.

He added:

"It seems possible to offer a one-way garage across the North Atlantic for as little as \$70, while carrying 55,000 lb. of freight." Conway maintained that conversion of the upper floor into all-cargo to all-passenger rate for doors is under 1 hr.

### Swing Nose

Dominant feature of the new configuration is the swing nose which loads cargo from the freighter to be used the flight deck. Two jacks support the aircraft when the nose is open. Passengers would be Rolls-Royce Tyne.

In designing the double-deck version, Short Brothers has provided three entry ways onto which cargo pallets can be loaded on the lower deck. Outside height of a load whether on a pallet or made a container, was estimated to be about 5 ft to reduce loading complications.

By keeping pallet height to 6 ft, Short Brothers can build an airplane to haul the 55,000 lb. of cargo, while providing more on the upper deck for 150 passengers. If a full cargo load was carried total weight would be about 60,000 lb. on the lower deck, and an additional 40,000 lb. on the upper deck.

The company decided on a swing nose, against rear loading, to save time on idea for a rear door and ramp was discarded for a marked saving in structural weight. Passenger screens allow for individual storage of baggage, with larger packs being transported in freight.

### Subject to Change

Short Brothers has emphasized that the follow-on to the SC.5 is a design study and that no orders have been placed as yet.

Configuration could be subject to change on the basis of individual airline needs.

However, to give interest in the craft



DRAWING OF Short SC.5 freighter and version of the RAF turboprop freighter shows large port for swaging nose well behind flight deck. Note supporting jacks.

SC.5, the company also has designed a cargo terminal for a North Atlantic operation, in which containers would be packaged at a factory or made up at the terminal and loaded aboard the airplane by means of trailers.

For unloading, the SC.5 would use a mechanized ramp open to nose and discharge the cargo onto a rail trailer, which is then mounted side and another trailer moved to the nose section for reloading the freighter.

Conway estimated that the entire operation could be completed in about 10 min.

### New Approach Urged On Service Problems

Washington—Civil Aeronautics Board is urging communication and action to try to settle adequacy of service problems among themselves before bringing long costly investigations before the board.

In a letter to airlines, state and local governments and new organizations, the board has outlined its new approach to settlement of adequacy-of-service problems and indicated the role of its newly created Office of Community Relations in the field. The board says communication and action to settle service problems among themselves should take full CAB action the services of its Office of Community Relations to handle the difficulties.

The office—created last March during reorganization of the Board—was headed by Chairman Alex S. Boyd—is headed by

former chief of the Routes Division John W. Dwyer. Dwyer hopes he can resolve adequacy-of-service controversies before they reach the Board in a formal investigation by promoting mutual understanding of airline problems and community demands for more service within the framework of the Federal Aviation Act. Dwyer says his role is the proceedings in a "conciliatory spirit" rather than a mediator.

The Board and its Office of Community Relations currently are seeking suggestions from airlines and communities to help establish long-range standards to determine how much service a community should receive.

Now, present adequacy-of-service problems stem from progress within the airline industry itself. The impact of turboprop aircraft on service to smaller communities has been substantial, with service declining at other places where the traffic cannot support high capacity jet transports.

Two suggestions the Board feels worth exploring include regional airports—communities could get together within a certain area and decide which of several airports should be used to provide adequate service, or perhaps build an airport better located to serve them all. The second idea involves better marketing. Service communities could determine whether their needs could be served by non-scheduled carrying service from a central airport to a larger airport offering jet service. The connecting service could be provided by a truckline or a short-range carrier, depending on the market.





**AUTOMATIC SKY FIGHTER.** Superworld. During attack: U.S. Air Force's push for new defense weapons against airborne missiles and attacking bombers. New "B" models have scored test victories up to 440 miles from base at altitudes of more

than 100,000 feet, outstripping new evidence in defense missile records for range and altitude. Boeing's models are now operational at the U.S. Air Defense Command bases. B models will be installed at six bases in the United States and two in Canada.

## Capability has many faces at Boeing



**WIND BOMBE.** developed by Boeing subsidiary, Wind Research, Inc., will measure wind direction and velocity at wide range of altitudes, transmitting data back for control use at missile launch ranges, other weather stations.



**SPACEWALK'S BLAST-OFF.** Boeing Space Medicine research projects for manned flight, wearing help of Boeing developed miniature electronic instruments which measure movements in various required by take off of space vehicles.



**JET-PROPELLED TEST BED.** now being built for Boeing, will be used to test experimental engines and subsonic aircraft research designs at speeds up to 100 knots. Test models will be suspended in large test beds. Test bed will operational Boeing test records in air, carrying knowledge in area of hydrodynamics.

**BOEING**

## Airline Traffic—February 1961

	Revenue Passenger Miles	Passenger Load Factor %	U. S. Mail Ton-Miles	Revenue Ton-Miles	Weight Ton-Miles	Total Revenue Ton-Miles	Over-all Revenue Load Factor %
<b>DOMESTIC TRAFFIC</b>							
American	362,744	86.9	1,607,418	688,855	6,394,513	7,690,786	88.6
Boeing	179,157	88.8	868,830	376,710	3,436,467	4,681,907	90.4
Capital	120,444	88.7	552,241	239,814	2,197,401	2,989,456	88.9
Continental	100,271	88.6	479,746	149,676	1,322,791	1,952,113	88.6
Delta	201,871	84.9	938,271	381,213	3,437,976	4,757,460	84.9
Eastern	489,666	84.2	2,122,227	911,213	8,399,400	11,432,840	84.2
Midwest	17,227	88.1	76,439	32,880	294,881	404,198	88.1
Northeast	170,732	88.4	764,470	324,470	2,944,470	3,993,410	88.4
Northwest	7,888	88.1	34,400	14,400	131,400	180,400	88.1
Trans World	181,014	88.1	1,148,343	447,400	4,047,400	5,642,843	88.1
United	274,427	88.4	1,211,427	511,427	4,611,427	6,334,271	88.4
Western	75,666	88.1	316,340	131,340	1,211,340	1,658,680	88.1
<b>INTERNATIONAL</b>							
American	1,400	70.6	8,317	234	207,281	215,842	70.6
Boeing	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7
Coast-to-Coast	35,720	88.1	1,148	2,148	194,470	196,618	88.1
Delta	1,279	88.1	1,200	10,000	172,881	184,081	88.1
Eastern	38,261	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Midwest	1,400	70.6	8,317	234	207,281	215,842	70.6
Northeast	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7
Northwest	1,279	88.1	1,200	10,000	172,881	184,081	88.1
Trans World	38,261	88.1	1,148	2,148	1,421,449	1,569,621	88.1
United	1,400	70.6	8,317	234	207,281	215,842	70.6
Western	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7
<b>LOCAL SERVICES</b>							
Airway	41,414	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Boeing	34,770	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Capital	11,644	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Continental	88,120	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Delta	3,700	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Eastern	48,174	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Midwest	17,227	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Northeast	7,146	50.7	1,148	2,148	1,421,449	1,569,621	50.7
Northwest	1,279	88.1	1,200	10,000	172,881	184,081	88.1
Trans World	38,261	88.1	1,148	2,148	1,421,449	1,569,621	88.1
United	1,400	70.6	8,317	234	207,281	215,842	70.6
Western	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7
<b>NAUTICAL</b>							
American	21,470	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Boeing	18,120	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Capital	3,350	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Continental	1,400	70.6	8,317	234	207,281	215,842	70.6
Delta	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7
Eastern	38,261	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Midwest	1,400	70.6	8,317	234	207,281	215,842	70.6
Northeast	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7
Northwest	1,279	88.1	1,200	10,000	172,881	184,081	88.1
Trans World	38,261	88.1	1,148	2,148	1,421,449	1,569,621	88.1
United	1,400	70.6	8,317	234	207,281	215,842	70.6
Western	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7
<b>HELICOPTER UNIT</b>							
Boeing	10,400	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Capital	1,400	70.6	8,317	234	207,281	215,842	70.6
Continental	1,400	70.6	8,317	234	207,281	215,842	70.6
Delta	1,400	70.6	8,317	234	207,281	215,842	70.6
Eastern	1,400	70.6	8,317	234	207,281	215,842	70.6
Midwest	1,400	70.6	8,317	234	207,281	215,842	70.6
Northeast	1,400	70.6	8,317	234	207,281	215,842	70.6
Northwest	1,279	88.1	1,200	10,000	172,881	184,081	88.1
Trans World	38,261	88.1	1,148	2,148	1,421,449	1,569,621	88.1
United	1,400	70.6	8,317	234	207,281	215,842	70.6
Western	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7
<b>ALASKA SERVICE</b>							
American	8,317	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Boeing	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7
Capital	1,171	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Continental	1,400	70.6	8,317	234	207,281	215,842	70.6
Delta	1,400	70.6	8,317	234	207,281	215,842	70.6
Eastern	1,400	70.6	8,317	234	207,281	215,842	70.6
Midwest	1,400	70.6	8,317	234	207,281	215,842	70.6
Northeast	1,400	70.6	8,317	234	207,281	215,842	70.6
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United	1,400	70.6	8,317	234	207,281	215,842	70.6
Western	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7
<b>ARCTIC SERVICE</b>							
American	8,317	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Boeing	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7
Capital	1,171	88.1	1,148	2,148	1,421,449	1,569,621	88.1
Continental	1,400	70.6	8,317	234	207,281	215,842	70.6
Delta	1,400	70.6	8,317	234	207,281	215,842	70.6
Eastern	1,400	70.6	8,317	234	207,281	215,842	70.6
Midwest	1,400	70.6	8,317	234	207,281	215,842	70.6
Northeast	1,400	70.6	8,317	234	207,281	215,842	70.6
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Western	7,146	50.7	38,123	111,449	1,421,449	1,569,621	50.7

\* Not available. \* Operation suspended. \* Indicates less suspended service in Revenue, the only international route. Compiled by AIRCRAFT WEEK from airline reports to the Civil Aeronautics Board.



## Olympus— for supersonic economy at Mach 2 plus

An advanced version of the Bristol Siddeley Olympus is now under intensive development for British Aircraft Corporation's TSR 2. It will give this unique tactical support reconnaissance aircraft an economic performance at speeds up to Mach 2 and over.

### THE RIGHT QUALITIES...

The Olympus has the ideal thermodynamic cycle for the economic propulsion of a supersonic aircraft at Mach 2 plus and embodies all the qualities essential for such an application: high power at high altitude, extremely low fuel consumption, great operational flexibility, a long overhaul life, a very high thrust/weight ratio, and excellent handling qualities.



Arco Vulcan Mk 174 engine

### ...PROVEN IN SERVICE

The Olympus has proved itself in several years' service, as the powerplant of the Arco Vulcan F.1 bomber, to be one of the most successful turbojets ever built. Maintenance is exceptionally low—last year, for example, on a 28,000 mile, round-the-world tour, the maintenance required was almost negligible.

The truly outstanding bulk in potential of the Olympus has been confirmed by the threshold increase in power from the 11,000-lb thrust day of the original production engine, to the 30,000-lb thrust with intent of the latest version.



Olympus engine test cell, Bristol Siddeley

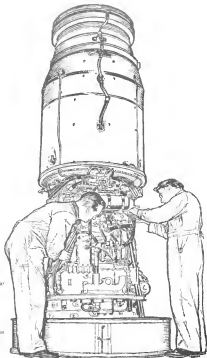
### SUITABILITY FOR SUPERSONIC AIRLINES

Already selected for the BAe's most up-to-date supersonic aircraft, the Olympus will clearly require only minor changes to adapt it to the requirements of a supersonic airliner in the same speed category.

### BRISTOL SIDDELEY ENGINES LIMITED

For further information please write to:  
Bristol Aero Industries Limited,  
MQ40 Per IX, Redwood, Marston,  
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AGENTS, AND AIRCRAFT MAINTENANCE  
ENGINEERS  
TELEPHONE: 0454 5111111111111111



## AIRLINE OBSERVER

► Opposition to the grant of a Los Angeles route to KLM (AW Apr. 26, p. 58) continued to grow last week as Dutch and U. S. delegates met to discuss bilateral agreement talks supported by President Kennedy's instruction. Air Transport Assn. has been waging an intensive campaign against the proposed route authorization, and the Civil Aeronautics Board opposes the move. State Department, which flatly refused to grant the route last week, has set three basic requests as conditions for granting it now. These would require KLM to hold separate no 1000 subside loads, restrict F400 Freedom traffic to 20% of total U. S. Netherlands traffic and define "stopovers" as a 72-hr period. Passengers traveling beyond Amsterdam, spending less than 72 hr there, would be considered F400 Freedom traffic.

► Watch for Texas World Airway to take a broader view of airport possibilities now that Howard Hughes' control of the airline is temporarily shelved. TWA is likely to examine the entire airport spectrum rather than confine itself to the Northeast Airlines negotiations, where Hughes had interests in both parties. Because of its Florida route, Northeast is still a major prospect, but TWA also is likely to consider others that might give it alternative southern, off-season routes or that might strengthen its international routes.

► American's 70-passenger, twin-engine Tu-104s will continue to fly Bama's trans-Siberian Moscow-Khabarovsk route despite suspension of regular nonstop service with Tu-114s beginning tomorrow last month (AW May 1, p. 52). Initial trip programs, with the 170-passenger Tu-114s only twice weekly, scheduled Moscow-Khabarovsk flying time for the Tu-114 is about 9 hr. Tu-104s make two intermediate stops on the 158-mi. route. Turnaround times are, but not less, 99 min, compared with 119 for air.

► Federal Aviation Agency analysis of air traffic controller's activity while making loss shifts in the New York Center has indicated that individual controllers spend up to 14% of their time processing routine paper work and up to 25% solving intra-sector coordination problems. More than 1,000 observations per volume were collected at 10 sec. intervals during shifts when the number of pilot position reports was twice the average level.

► International Air Transport Assn. and Air Transport Assn. have agreed on a universal interface message format suitable for both manual and machine handling. Format permits automatic messages to move automatically through data processing machines and board communications systems of airlines without requiring messages to conform to standards of a particular airline.

► Federal Aviation Agency, after consultation with Air Transport Assn. and Air Line Pilots Assn., will undertake a study of how pilots establish their cockpit activity by daily subject. Prime purpose of the study is to establish criteria for automatic flight aids.

► Finnish airline Aero O/Y, Finnair has begun direct service between Moscow and Helsinki with tied Convair turboprop.

► Delta Air Lines will begin its southern transcontinental service June 11 with four round trips daily, using Douglas DC-8s and DC-7s and Convair 440 equipment. One DC-8 flight will operate nonstop between Atlanta and Los Angeles and a second will fly between the two cities with a stop at Dallas. The Convair 440 flight will serve the Atlanta-Los Angeles route with stops at New Orleans and Fort Worth. The DC-7 flight will operate between Jacksonville and San Diego with stops at Orlando, New Orleans and Dallas.

► Domestic airline common stock listed on the New York Stock Exchange was again attracting revivified interest last week in a market that generally closed both sharp declines and advances in heavy trading. At mid-week, five of the eleven airlines listed—Delta, Northeast, United, Capital and Western—reported new highs for the year. Michael showed a strong gain following a Civil Aeronautics Board order permitting the carrier to sell 400,000 shares of Pan American stock. Pan American stock reported only a slight drop when the Board order was issued.

## SHORTLINES

► American Airlines reports its 16 new, 400-seatwide aircraft replacement, among Electra II and DC-8s equipped, have been introduced in the New York area. The service was scheduled for introduction in Washington May 15 and in Chicago and Dallas May 20.

► Civil Aeronautics Board has rejected Eastern Air Lines plan to identify its Pratt & Whitney JT8 turbojet-powered DC-8s as "DC-8s." Eastern had offered to label the designation as strictly an icon.

► Continental Airlines has asked Civil Aeronautics Board to permit low night coach fares on its Boeing 707 flights beginning June 11 over the Los Angeles-Phoenix San Antonio-Dallas route overnight service, in the Southern Transcontinental Service Class.

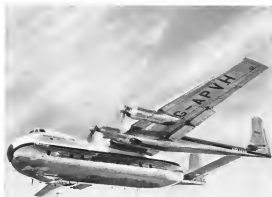
► Eastern Air Lines will begin construction of a major jet terminal, one of Miami International Airport about Sept. 30 with funds from a \$17.5-million bond issue already approved by the Dade County Port Authority. The bond issue will be paid through Eastern lease fees on the new buildings.

► Federal Aviation Agency pilots authorized to test aircraft for official business will be qualified under new rules in one or more of these four categories: 1-2 place single engine propeller-driven, 3-5 place single engine propeller-driven, twin-engine propeller-driven, four-engine turboprop, less than 12,500 lb., and helicopter. Pilots will operate in authorized to test and bring the permitted categories and will be required to take a proficiency test once a year.

► International Air Transport Assn. claims 6.6 million passengers traveling between Japan, Hong Kong, the Philippines, Australia, New Zealand and the Pap. Islands and Taiwan, the estimated U. S. and Canada to aviation negotiations are less than 72 hr before departure. The new policy is an effort to eliminate confusion.

► Pan American World Airways will spend \$1.5 million dollars to promote the West U. S. A. program abroad through magazine and poster and local advertising campaigns in 750 of its overseas offices.

► TAI, independent French airline, has begun twice weekly DC-8 service from Los Angeles to Tahiti, using the new 11,200-lb. monocoque at Papeete's airport. Flights operate via Papeete on Thursday and nonstop on Friday.

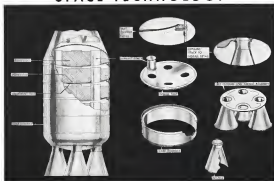


TODAY'S  
ECONOMICAL  
AIR FREIGHTER

# ARGOSY

HAWKER SIDDELEY AVIATION

30 Duke Street, St James's, London, S.W.1.



**DESIGN FEATURES** and components for a segmented solid-booster engine proposed by Atlantic Research Corp. "Vacuum propellant" would be pumped into burning trays while the launch vehicle is on the pad. The company says a vehicle using this test could be ready by 1964. Atlantic Research has built about 100 small solid-booster engines successfully.

## Advanced Solid Booster Concepts Studied

Washington—Industry is continuing to take advantage of the future provided by the House space committee to propose advanced space booster concepts—largely in the solid propellant field—designed to provide a substantial price increase in U. S. payload capability.

Latest propulsion comparisons to take advantage of this future were Atlantic Research Corp., which has developed the technology for a viscous fuel, low-maintenance ground booster (AW April 24, p. 51), and Grand Central Rocket Co., which has conducted a launch vehicle development study for a manned lunar landing.

Propulsion hearings began in March (AW Mar. 20, p. 50) and covered a wide spectrum of potential solid, liquid and nuclear engine theories aimed at surpassing the payload capabilities of the Saturn. The hearings are part of the National Aeronautics and Space Administration's Fiscal 1962 budget authorization hearings before the House Committee on Science and Astronautics.

Chairman Charles B. Rosten (D-La.)

set the stage for Atlantic Research and Grand Central proposals by expressing concern over absence of a backup vehicle for Saturn, and the U. S. intent to take advantage of the potential of large segmented solid boosters.

The Atlantic Research gel-solid concept, which the company hopes to sell both to NASA and the Defense Department, is designed to provide economy, reliability, stress flexibility and low drag cost not available in all-liquid or all-liquid systems.

The engine is essentially a series of compartments with a central exhaust stack to the nozzle. Compartments, called trays, support the propellant which has the consistency of toothpaste. A positive spacer is part of each tray, and all compartments in a stage are equal in construction.

The gel trays support the top of the compartment, which is shaped to direct the flow into the mouth of the segmented exhaust stack.

Propellant mass fraction of 83.5 is quoted as comparatively heavy vehicle to support trays and exhaust stacks. The company estimates that the

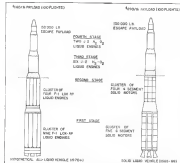
weight increase is more than compensated by small design simplicity and low fuel cost. With a high rate of production, Atlantic Research says the propellant can be delivered to the launch vehicle for 50 cents a pound.

Hardware for the gel-solid booster would be similar to distribution columns used for the chemical industry, with a rubber-lined insulation liner to protect the metal parts against heat corrosion. Thrust vector control requirements are similar to those for solid engines, and Atlantic Research favors control by secondary injection of exhaust gas.

Dr. Arch G. Sawicki, Atlantic Research president, says no advantage to the gel-solid concept for small launch vehicles, but he feels the advantage grows steadily with increase in booster size. The company has made about 100 trays using small motors and clamps assembly workers in ballistics operations.

Detailed engineering studies have been made on these two boosters using the gel-solid concept.

• Million-pound thrust system, with a three-burner test. Major would have a 10 ft diameter gross loaded weight



**GRAND CENTRAL ROCKET CO.** comparison of cost and thrust for all liquid and liquid solid manned lunar launch vehicles. Company says no backtracking required to produce vehicle at 45 ft. One of the low segment nozzle-stage motors Grand Central says could be in place for Saturn boosters.

of 216,000 lb. and a propellant weight of 152,000 lb. The booster, about 30 ft high, could be test flown 25 months after the program begins, and development would cost \$11.5 million, the company says.

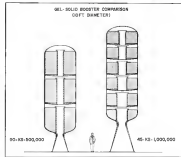
• A four-stage system, also with a 45-sec burning time. Gross weight of the 20-ft diameter vehicle would be 325,000 lb., of which 658,000 lb. would be propellant. Company feels this vehicle could be flown 10 months after a program was started, and development would cost \$78.5 million.

Basic advantages of the gel-solid concept center around its low cost and ease of handling, according to Atlantic Research. Production involves mixing and mixing with segments by truck can. Propellant would be dropped as a Gel-Solid explosive the same as solid rocket engines.

Propellant tracking and burn sequence factors, which have plagued solid grain technology, are eliminated in production, shipping, burning, storage and loading, the company says. The pumpable propellant requires no environmental controls for loading, which would be made in an inert vehicle structure. Booster loading would be the final step before launch operations.

Although stretchouts had not been determined for extended periods, the company believes that the propellant could remain viable for at least one quarter-century up to several months.

Atlantic Research says the gel-solid is adaptable to segmented design, in size and configuration of the burning trays.



**TWO COMPARISONS** of the Atlantic Research Corp. gel-solid booster built with a 45 million lb. total impulse. Secondary system would be used for thrust vector control. Company says a 1 million lb. thrust engine could be developed for flight demonstration for \$10.5 million.

The company feels booster segments could be constructed inexpensively by segment fabrication. The motor case and nozzle bay segments would be made of an aluminum alloy steel. Propellant trays would be stainless steels or steel, and exhaust stacks would be inserted in the trays before installation. The engine air stream would be a steady pressure zone of air-blasted also steel.

The Grand Central Rocket presentation was pointed toward a concept for a solid-booster manned lunar landing vehicle with the added virtue of being a backup as substitutes for the Saturn.

Dr. Claude Brannett, Grand Central president, said NASA should spend a minimum of \$50 million on large solid booster development in Fiscal 1962. The agency has requested \$1.1 million in this field.

Under contract questioning, Dr. Brannett and he feels NASA solid rocket programs should be distinct from nuclear programs like Polaris because system requirements are not comparable.

If authority to move ahead on a large segmented solid booster were received by September, Dr. Brannett said the U. S. could have a manned lunar launch vehicle ready for an operational mission by 1965 or 1966. Booster would be a cluster of the segment motor and second stage would be a cluster of four-segment engines.

Third stage would be a cluster of six hydrogen oxygen J-2 liquid boosters.



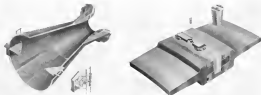
## The pilot is inside, flying over enemy lines.

The SD-1 Surveillance Drone flies remotely controlled tactical surveillance missions without risking manned aircraft or pilot. It is extremely mobile, simple to use and maintain, and can be readily adapted to carry TV or

film cameras, infrared, radiation detectors or radar reconnaissance equipment. The SD-1 is the Army's only operational surveillance drone. Northrop's Radioplane Division developed and produces it.



**RADIOPLANE**  
A Division of  
**NORTHROP**



**JET VANE** arrangement for direct vector control in the large segmented solid booster proposed by Good Control Rocket Co. Company also is showing fluid supplies to control thrust vector. Tapered pin joint would be used to connect segments of the solid motor (right).

gas engines, and fourth stage would be a cluster of two J-2s.

Earliest date for an all-liquid booster with a booster stage consisting of the Aerojet-engines 1-1 with a comparable engine mixture payload of 110,000 lb. is after 1970, according to Good Control. Both vehicles would use J-2 engine arrangements in third and fourth stages.

### Company Concept

The company concept, based on studies made for the Air Force and NASA, is centered around two basic sections.

• **Five-segment configuration** with an average thrust of 2.57 million lb., having time of 70 sec. Motor is 100 ft. long and 15.5 ft. in diameter. A cluster of four of these motors would be the second stage of the launch vehicle for the lunar landing vehicle, and one of the four motor segments could back up the Saturn.

• **Two-segment arrangement**, with an overall length of 155 ft. and diameter of 15.5 ft. Cluster of five motors with this configuration would be the basic landing vehicle booster stage.

In addition to converting time for availability, of early test programs, Dr. Brueckert said, the solid booster has a significant cost advantage over the liquid booster. Cost of developing a vehicle based on the F-1 will total \$2 billion through 10 development flights. Comparable development cost of the large solid first two stages would be \$132 million.

Good Control cost studies show a pre-burn-out of \$600 per pound for its proposed, all-liquid, manned lunar launch vehicle, and \$1,160 per pound for the F-1 based vehicle, assuming the cost is about \$100 per pound.

The solid booster can be fabricated "by standard manufacturing techniques from standard materials," Dr. Brueckert said.

He added that no breakthroughs are needed in metal parts; the rubber-lined propellant pump is a type with which the industry has experience, and nozzle manufacturing can make up existing nozzles to meet the large engine requirements. He said three manufacturing "will subject fluid power beds" to produce nozzles.

### Studies Urged

Dr. Brueckert urged immediate studies of direct vector control by jet use as fluid injection, plus studies of nose and nozzle materials and fabrication techniques.

He said that with these studies, the design can be known in 12 to 18 months, and will "give assurance that the goal of manned lunar landing will be achieved at the earliest possible time and at the lowest cost."

## Randt Cites Manned Space Flight Hazards

New York — Robert Randt, one of the greatest known hazard and weightless men, the greatest unknown hazard is manned space flight, Dr. Clark L. Randt told a meeting of the American Astronautical Society here recently.

Magnitude of the radiation-hazard problem is as the same order as that of atomic reliability, he said. But the advantage is that the radiation problem is fairly well understood. In contrast, little is known about the effects of weightlessness, and no American who has had more than about one minute's exposure to the phenomenon.

Experiments on the sensory system of rats subjected to simulated weightlessness have shown that a lack of aversive inputs caused wide swings in the clothing responses of their systems with a marked elevation in blood pressure. The rats had burning, engine-recessed suspensions, were blindfolded and submerged in water, while electroencephalograms (EEG) and blood pressure readings increased the rats' mental and physical activities. After one and one-half to two hours, the EEG showed wild swings as the brain's alerting responses, cycling in and out over two periods that increased as time passed, accompanied by blood pressure rises.

The explanation of these experiments, said Randt in his first public appearance since he resigned as director of NASA's Office of Life Sciences, is that activity in the brain due to a continuing process which is normally inhibited and controlled by outside sensory inputs—light, hearing, touch and effort. Lacking these, the internal feedback goes wild and produces the swings in the brain.

This effect could be produced by pro-



**DELOLID** propellant is pumped in a state and loading operation at the Atlantic Re search Corp. plant.

## SECRETS OF FIFTEEN HUNDRED MODELS



### This Design Feature Holds the Secret of the Greater Reliability in All 1544 Daystrom Squaretrim™ Models

All Daystrom Squaretrim potentiometers have this in common: our unique wire-in-the-groove resistive element. We start with an annealed strand. We then wrap the strand with resistive wire. But... and this is our exclusive process... just ahead of the wire is a tiny diamond tool which cuts a carefully controlled groove in the strand's insulation. The wire is then wound tightly into this groove throughout the entire helix. As a result, each turn remains securely separate from the adjacent turn, thus anchoring the wire so that it will withstand severe shock and vibration without slipping up and shorting out.

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ingred weightlessness. Resnik said, and this is certainly one of the major problems in the field of manned space flight.

Other points made by Resnik in his presentation:

- Cost of the Mercury project is not pointed on a basis of the return of scientific information alone, but on the fact that this work must be done as a necessary first step in manned space flight.

- Most valuable result of Mercury is far from the accomplishment of complex performance by chimpanzees. It is a simple fact, says Resnik, that man has been in a large field, and we watch him on the life scale, then the days which have been used by the Russians as an extension of their previous experiments.

- First major contribution to manned space flight was made by the Russians with Sputnik 2, which proved that animal life could survive in the hostile environment of space. It is not yet known how long Lada, the first dog, lived in orbit, but scientists are that the time period was perhaps two or three days.

- Manned space flight benefits on earth-based medical problems are expected to be substantial in vision, field of vision, in medical rehabilitation, in understanding of the human system and brain function, and increased knowledge of biological functioning are expected to be in the field of "biological" from the program.

### Vought Building Small Space Recon System

Dallas, Tex.—A space reconnaissance system, light and small enough to be carried by a Scout-class rocket vehicle, and capable of taking detailed, high resolution photographs even at low light levels, during the target and retransmitting them to earth on command, is being developed here by Chance Vought Corp.'s Aerospace Division under a contract from Bureau of Naval Weapons.

Called mini Charge Storage Transducer and Repetitive Scanners, the system is based on an entirely new concept in coding to its inventors, C. L. Boulden, who also is division technical engineer. A test version of the system has been built and demonstrated general capabilities, according to Clarence Vought, and the Navy contract for more than \$750,000, is for development of an advanced version for evaluation. It has applications for reconnaissance in the earth's atmosphere as well as space, according to Boulden, and is lightest weight to achieve coverage from such phenomena as the Van Allen belt.



## THIS IS THE "FIRST TEAM" in aerial target scoring systems

This team of weapons testing specialists, which provided the military air services of the United States and Canada with the only operational proven scoring device for air-to-air missile results, has now developed the first system to meet the following requirements:

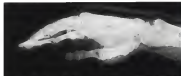
- Scores irrespective of missile size and velocity
- Requires no modification of weapons
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- Gives visual display of hit-miss results while providing self-sustained data to participants for direct read-out in recording
- Provides continuous/continuous sensitivity
- Is ultra lightweight (less than 15 pounds)
- Imposes no speed limitations on target

This is another breakthrough from Del Mar, where the defense of the free world is our business.

For more information on Del Mar's proven capability write Dept. AT-4143-6.



INTERNATIONAL AIRPORT LOS ANGELES 44, CALIF.



X-RAY of the hand of Capt. Charles L. Wilson after exposure for seven minutes to 4 atmospheres shows swelling in almost double normal size. In a series of experiments to determine the effects on tissue exposed to low pressure, Dr. Wilson found the swelling subsided accordingly on reexposure. Swelling is caused by carbon dioxide and expanded water.

## Tests Show That Exposed Skin Swells in High Altitude Operations

Chicago—Capt. Charles L. Wilson of Wright Air Development Division reported at the recent 73rd meeting of the Aerospace Medical Assn., in a series of experiments which show carbon dioxide gas in combination with water vapor causes swelling of unprotected skin tissue at high altitude operations. Swelling, which frequently doubled the size of the test subject's hands, was observed in tests of 10 to 20 minutes.

Dr. Wilson told American West that experiments show a distinct change of tissue reaction from faulty or badly fitted pressure suits, while escape capsules give the greatest protection.

Captain, now undergoing qualification tests, lately was descended by James F. Heggenwald, Jr., North American Aviation project engineer on the B-70 air-cushioned escape seat.

North American sets potential use of the seat in re-entry vehicles since it provides pressure and atmosphere protection for a crewman in a short-term emergency.

The North American escape capsule has been tested in 35 atmospheres and tested exposure over a velocity profile from 90 to 2,000 mph. Significance of the tests, Heggenwald said, is the ability of the crew to perform without continuous clothing.

Whitford Corp. developed a completely self-contained kitchen for a three-man spacecraft which would provide 126 meals for a 14-day mission. Heaters, refrigerators and condenser, is used to control danger of food poisoning.

Crewmembers are sprayed with the chemical after use.

The kitchen console was designed for emergency operation and pressure would not hold fluids from tubes

and container liquids through supply.

Dr. David G. Swenson, chief of the USAF School of Aerospace Medicine's biomedicine branch, said the best research tool for monitoring exposure to heavy pressure comes now in the high altitude balloons, barometric cockpit flights are too short in duration and conditions from aircraft flights are difficult to analyze because of the large fluxes from the Van Allen belts.

Other studies in radiation included:

- Eye damage from radiation dosage can be immediate or delayed, and is mostly temporary, according to a study by the School of Aviation Medicine made with rhesus monkeys. Data is still needed to determine whether eye tissue will suffer from damage or follow electron softening.
- Biological effects of galactic primary cosmic radiation according to a study made by Dr. Swenson, indicate more damage to organisms of cells than to the individual cells.
- Exposure to cold may reduce the onset of tumors which result from radiation exposure. North American reported a group of 60 rats to which body radiation and then exposed part of the group to three-hour periods of near-degree temperatures. Those exposed to cold had reduced incidence of tumors.

• Direct experimental approach is required to assess the relative biological equivalent of heavy primary cosmic rays using laboratory tests using rat tissue substitutes cannot give an accurate answer, says because exposure is protracted for too long.

Dr. Florence J. Schaefer of the Navy School of Aviation Medicine said extended balloon flights are necessary to determine radiation exposure levels for the "human target in space."

• Radiation can produce induced electrical and chemical changes through supply.

• Radiation can produce induced electrical and chemical changes through supply.

## PROJECT NERV



From the first Nuclear Emulsion Recovery Vehicle (NERV) launch and recovery on September 15, 1960, came these important accomplishments:

**Highest Space Probe at a Reentry Vehicle**—The B-615 NERV (19" wide and 17" high) was recovered after a 1200 mile high flight into the outer Van Allen Radiation Belt.

**Extended Measurements of Space Radiation**—A disc, 1/2" thick and 3" wide, extended from the vehicle during flight, exposing a stack of 25 layers of special emulsion to the radiation particles. Recovery permitted scientists to analyze the emulsion directly.

**First Re-entry at a Vehicle with a Bacteriological Seals**—The NERV vehicle rose, reentered, and reentered to permit exposure of the payload, was the first "bacteriological" surface to survive the intense heat of re-entry. Performance of the vehicle was successful in all respects.

General Electric's Missile and Space Vehicle Department designed and built NERV for National Aeronautics and Space Administration's Goldenrod Space Flight Center. NERV is a department of the G.E. Defense Electronics Division.

GENERAL ELECTRIC

NERV is the National Aeronautics and Space Administration's accurate "census" to obtain a clear picture of space radiation. The Nuclear Emulsion Recovery Vehicle, built by General Electric's Missile and Space Vehicle Department, probed 1200 miles in space. It returned with comprehensive radiation intensity measurements from various altitudes and positions within the outer Van Allen Radiation Belt.

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These Beacons have been developed for the U.S. Air Force in cooperation with the Convair Fort Worth Division and the Boeing Transport Division.



Bendix-Pacific Radar Beacons provide identification, range and altitude information for radar scope resident. The Rendezvous and Position Indicator Beacons are installed on the B-58, the Position Indicator on the KC-135.



Bendix-Pacific engineers are always available to discuss your specific problem.

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NORTH HOLLYWOOD, CALIFORNIA



### Japanese to Develop Weather Rocket

Japanese weather observation rocket (mitsun petrel) is designed to obtain 10-m. altitude with 40-lb. payload. Mitsun petrel rocket is rocket would take payload at 1/2 000-sec. delay (speed less 200 sec.). Japan's Science and Technology Agency budgeted \$13,181 to develop and manufacture the 25-ft-long, 57-lb. liquid-propellant rocket, which would measure atmospheric temperature, wind velocity and wind direction. The Agency expects to launch the first rocket from the southern tip of Kyushu Island in 1982.

trial circuits through a space vehicle electrical system, crew utilization and heating of materials, crew vehicle deployment or crash to transmission of data in the vehicle system—according to a North American Aviation spokesman. Civilian Mission called for extensive experimentation to establish launch vehicle requirements for electronics and electrical systems.

Large number of reports in the bio-electronics field indicate the expanding medical interest in noninvasive or noninvasive and telemetry for

remote space missions. Dr. J. L. Back of the USAF School of Aviation Medicine has defined a unit of activity related to human space which essentially means the degree of alertness.

He told Avionics West that a good baseline can be established and when a criterion falls below normal during a space mission, an astronaut's room warning could occur to inform other crewmen in ground station of the failure. Deviation from the norm could mean boredom, which would be corrected by a space or it could result from oxygen loss, low blood pressure, fatigue or discomfort.

North American Aviation and Spacelab Inc. are developing a three channel FM/DM bioinstrument which will be permanently implanted in its human hosts of the test subject. The unit is designed for an Atlas launch vehicle test pod and will transmit heart beat, respiration and heart sound data. Kremen makes his last visit regularly implanted for one month with all effects.



### Plasma Modulation Tube

Plasma modulation tube developed by Mel Corp. for monitoring conditions that result in breakdown of communications with space vehicles during missions. Tube is filled with gas which are caused by radio attached to two "gun" centers and among three 8-inch top of tube is used to use plasma density, while two sets of double probes near bottom measure plasma density and temperature.

### Vought to Develop, Make Saturn Fuel Line Elbows

Second Saturn component contract, covering development and fabrication of eight-inch diameter, seamless, 40-in. wall thickness steel fuel line, "elbow" for fuel lines, has been awarded Chance Vought Corp.'s Attleboro, Mass. Division, by NASA's George C. Marshall Space Flight Center Huntsville, Ala.

Elbows will be designed to an ultimate tensile strength of 100,000 psi. Design must be applicable to various temperatures, with dimensions up to 37 in. with the possibility of later increase to 37-in. dia. Saturn requires more than 10 of the eight inch elbows for the first stage cluster of eight engines.

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## Whisker/Metal Re-entry Material Studied

Palm Springs, Calif.—Composite material half-whisker alloy and half-whisker metal whiskers, have been shown in impact tests to have four times the strength-to-weight ratio of the alloy alone over a temperature range of 1,000° according to William H. Sutton of General Electric Missile and Space Vehicle Department.

Sutton was reporting General Electric re-investigation of composite materials for space vehicle applications at an American Rocket Society symposium on lifting re-entry vehicles.

Sutton said the data used in his calculations represent neither the poorest nor the ideal case. One of the problems of making composites that include whiskers (filamentary strands) is to find a method of precisely orienting, wetting and bonding the whiskers in the metal matrix.

Sutton said, "So far fabrication techniques have been unsuccessful in obtaining stabilization of fiber bundles with molten metal has received the most attention. For preliminary studies,

aluminas and alumina fibers have been used as matrix glasses, primarily because of their relatively low wetting temperatures. Composites were made of aluminum polyethylene fibers, glass filaments and alumina whiskers. Emphasis was placed on studying and improving manufacturing techniques for producing sound composites. Several composites were tested in an Instron Tensile Test machine. In the fabrication of these preliminary composites, the whiskers were not prevented to penetrate bonding. It is evident that they did not pick up their share of the load, although they modified stress strain relationships considerably. A fibrous alloy was used as one case to increase the ductility of the soft and promote wetting of the fibers. There was an increase in fracture stress which was probably the result of better penetration of the metal into the fiber mass.

"A single continuous 15% whiskers showed a yield stress of 17,500 psi compared with 10,000 psi for the unreinforced alloy. Although the fracture

occurred at slightly more than 10% strain (the breaking strain of the whiskers) not all of the whiskers ruptured simultaneously, so that the fracture followed in progressive steps."

The General Electric staff has concluded that whisker-metal composites are going to be a new class of materials with greatly improved high temperature properties and strength-to-density ratios but their successful development depends on the solution of these interrelated problems:

- "Achieving maximum load transfer from the matrix to the fibers through the proper combination and selection of whisker and matrix compositions.
- "Ensuring strong coherent bonding between the fiber and matrix.
- "Utilizing only the strongest whiskers for reinforcement.

- "Fabricating composites such that the whiskers are fully oriented and chemically wetted and bonded to the metal."

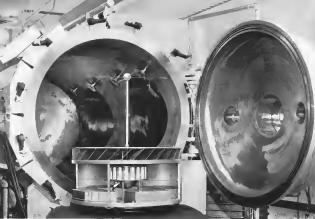
Sutton said it is too early to re-evaluate existing theoretical concepts



333,000-lb.-Thrust Segmented Rocket Motor Proposed

Models of the solid propellant segmented motor proposed by Defense Department Air Force and NASA by Aerojet-General (AFR) Apr. 24 p. 17) are at left. Elements include air element, forward head, and center section with propellant attached. Motor can develop about 333,000 lb. thrust at 60 sec burning time. Centers model (right) of Aerojet's look-alike propellant and aft, used to join motor segments, shows simulated steel insulating band in center and, above it, the rubber O-ring gasket seal. Steel bands are mounted at three spaced intervals in the circumference of the joint and pushed home by an explosive. Time of assembly is less than two minutes, Aerojet reported.





**PROGRESS REPORT: BENDIX SPACE LABORATORY** Another addition to our expanding Space Laboratory is this 4 x 8-foot space simulation chamber now operating at  $4 \times 10^{-9}$  mm Hg vacuum. We understand this is the hardest vacuum yet achieved in this size chamber. Integral wall heating and cooling allow test of small satellites and satellite subsystems at temperatures ranging from  $-300^{\circ}\text{F}$  to  $+500^{\circ}\text{F}$ . Accessories extend this range to  $-400^{\circ}\text{F}$  to  $+2000^{\circ}\text{F}$ . Our expanding facilities are creating career opportunities for senior personnel experienced in satellite and space system testing.

**BENDIX SYSTEMS DIVISION**  
ANN ARBOR, MICHIGAN



about compression. Not enough data is in to permit accurate prediction of the strength of metal-fiber composites. It is assumed that the elements rather than the matrix must carry most of the load in a compression. However, this also may strengthen the matrix by blocking dislocation wave fronts and retarding crack development.

With the elements all aligned parallel to a tensile load on the matrix, it is assumed that a filament crossed the load through shear fibers at an angle they make the matrix. General Electric scientists calculate that shear stresses are greatest at the end of the fiber where plastic deformation of the matrix is most likely. The whisker does not pick up much stress if there is no yield in the matrix because there is not enough strain in the matrix to stretch the whisker. The matrix and whisker only about 15 to 20 filament diameter to transfer the load into the filament. High peak shear stresses near the ends of the whiskers may point to the main structural problem in the development of composites.

#### Chromium Modifications

The ARS working shop heard David M. Savage of Bendix Corp. describe research in which chromium has been modified in the addition of cerium for even superhard steels at transient stresses over  $3000\text{F}$ . The method has also shown the ability to carburized a heat flux in air of  $400\text{ Btu per sq ft per sec}$  without erosion or structural failure.

Savage described the material as "a mixture of electroless chromium and an oxide of a Group II metal." It has been named Chromo-Cermet 90 or Chromo 10, for short. Exposure to air forms a complex, highly reflective oxide coating and does not lower the melt point of the chromium. Tensile strength at  $3000\text{F}$  equals that of Rose 44 at  $2200\text{F}$ . It can be cold worked, hot formed, or machined and is apparently easily in handle as conventional metal designs. It has a tensile strength of 1,500 psi with a modulus in area of  $10^5$  at  $1,100\text{F}$ .

In general chromium is not a particularly promising material for wear gliders at temperatures above  $2,000\text{F}$  while Chromo 10 will withstand an oxidizing environment at temperatures up to  $3,000\text{F}$ .

The ceramic content of Chromo 10 apparently increases the strength of the chromium matrix. Ceramic at the grain boundaries enables the material to hold considerable stress, even past the point of recrystallization. Microhardness of Chromo 10 is said to be similar to cast iron.

Savage believes it possible to achieve Chromo 10 with 30,000 to 40,000 psi strength within a year.

## LONG RANGE INPUT / 1794

News of the spectrum of Coult from the Americans was used in the French Radio-Commissariat Convention of Paris in a matter of minutes via Claude Chapin's winning telegraph system, or relay over telegraph, Sept. 1, 1794. A new era in rapid communication had begun.

Today, instantaneous and completely reliable Electronic Communications insure the immediate and continuous interchange of intelligence throughout the Free World. ECI is proud of its initiative and responsibility in the design, development and manufacture of high precision radio-tele equipment in the critical specifications required in various aerospace and surface roles vital to our National Defense and its scientific achievement. An example is ALICE-Melville Long Range Input—a program where ECI communications and data link equipment fill an important and essential requirement in linking USAF's advanced early warning equipment to SACs—our command and control network.



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### Plug Nozzle Rocket Engine Firing

Liquid is propellant plug inside rocket engine generating 90,000 lb thrust has been qualified by the General Electric Co. at its Mello Tech Station, Saratoga County, N. Y. as part of an investigation sponsored by the National Aeronautics and Space Administration. Plug nozzle concept is said to be the last radical change in rocket engine configurations. Designations, aims of increasing reliability and reducing costs of rocket propulsion system.



## Meteoroid Penetration Of Spaceships Studied

Possibilities that intense heat, light and blast would accompany a catastrophic penetration of a space vehicle and cripple or destroy occupants and equipment is radiated by Chance Vought Astronautics Division tests.

Studies at Chincoteague indicate a definite need for shielding or buffers for species colonies against possible meteoroid penetration, particularly, for those spending as much as 6 months for prolonged periods. Relatively short flights envisaged in the Mars or Titan-Saturn programs are not likely to pose as great a hazard.

Chamber Vought conducted tests with a simulated space vehicle chamber mounted inside a vacuum tank, during which two aluminum pellets weighed about two-thirds of a gram were fired into the chamber at approximately 17,000 mph velocities. The velocity approaches the speed of slower micro-meteoroids, average speed of such a particle is estimated as high as 158,000 mph.

\*Bright explosive-like flashes were common-occurred inside the test chamber each time it was penetrated by the pellets, and traces of aluminum oxide, such as would result from an explosion of aluminum, were also found inside the chamber.

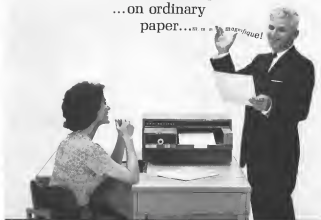
• Tests with rats indicated definite potential hazards to man in such an environment. In face of the knowledge that the chamber contained stored atmospheric pressure and composition. These animals suffered varying degrees of asphyxiation and burns and appeared to suffer from shock. Four of the five subjects survived the effects of the penetration. In a week's rest with the rat exposed to a 90/95% oxygen atmosphere, penetration resulted in asphyxiation, burning, blinding the subject instantly and totally depriving the organism

Data available leads to estimates that an average-size space vehicle with 1,000 sq ft of surface in a near-earth orbit might be passivated once in 16 hr if it had an aluminum skin 0.75 in. thick and once in 48 hr at 0.1 in. thick.

## Navy Formally Cancels Eagle Missile Development

Naval Department finally, awarded its Darko out-of-area missile development with the Bendis Corp. San Antonio. Missile Appropriations \$17 million of Eagle funding will be completed, with \$40 million obligated in Fiscal 1961 and \$47 million in Fiscal 1962. The money will be used to meet Navy limited war capability requirements and in accelerating Polaris A-3 missile development.

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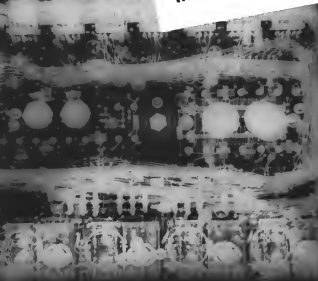
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the first time...



A key aspect of Donner missile hardware

*Picture yourself perched in a small capsule atop a large rocket, 90 feet above a Cape Canaveral launching pad. There are thousands of parts in that bird, and in a few seconds they will get the only reliability test that counts...will they work the first time?*

To all concerned with that question, we say this: To a large degree, the success of Mercury, as well as every other U.S. space vehicle and missile, will be assured by constant pre-occupation with RELIABILITY. The specialists in this particular field are the Quality Control departments of the many companies who work on these projects.

The X-ray at left illustrates one of Donner's painstaking approaches to reliability. The hardware shown is a unique Donner system for controlling one of America's most advanced and successful missiles. It uses standard Donner accelerometers (lower portion of X-ray) as basic components to detect overall missile acceleration. Once this parameter has been determined, the Donner system—actually a miniature computer—ensures flight performance by locating predetermined phenomena to take place in proper sequence. For instance, if, in the initial portion of the flight the missile has achieved sufficient velocity by a predetermined time, the Donner system slows stage ignition. If correct velocity has not been achieved the system shuts the flight. The missile continues its mission only as programmed.

As in all Donner systems designed to measure, interpret and control flight dynamics, the system at left **MUST WORK THE FIRST TIME**. To assure this, Donner enforces rigid quality control procedures. It allows inspection of all cutting and components, provides a further check of shodding position, dimensions, welding and coatings, and detects the presence of any foreign material.

#### Quality Control In Operation

**STANDARDS**—Donner's standards are regularly certified by the Western Precision Standards Lab., and by the Navy Standards Lab. located here in Concord. Our participation in the BWEP's calibration program allows ready access to the most complete facilities available anywhere. Donner's production testing equipment conforms even frequently used as secondary standards, for example K-3 Potentiometer and 0.01% differential voltmeter.



**ENVIRONMENTAL**—Photo above shows part of Donner's Environmental Test Facility. Included are vibration test equipment with random excitation shaker, shock motor, carriage, suspension, air spray, humidity and climate chambers, other general and special purpose test gear.

**SEATS OF THE ART**—Reliability measures, MIL specs, Gamma curves and detailed environmental test requirements are no strangers to Donner Scientists. 15% of Donner's total employment is directly associated with the Quality Control function. The rate reaches 10% on the most demanding projects, such as the system commanded by the X-ray.

**AS YOU KNOW**—There are two facets to reliability: (1) the dependency inherent to the product itself and (2) the absolute assurance that the product under review is the best possible tool for the particular job. Donner Scientific maintains a staff of competent personnel whose primary job it is to assist the engineer or scientist in the application of our problem solving tools to his measurement or control projects, using the latest developments in testing and digital techniques.

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CONCORD, CALIFORNIA



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Temperature-control  
element components, the  
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temperatures, for control  
systems, and as sensors for  
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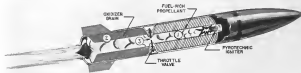
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## MISSILE ENGINEERING



SCHEMATIC drawing of Ansel throttleable solid-propellant rocket shows tandem grains of fuel and motor-rich propellant.

## Solid-Propellant Motor Throttled in Tests

By David A. Anderson

New York—Feasibility of a throttleable solid-propellant rocket motor has been demonstrated in a series of static firings at Ansel Propulsion Inc.

Test runs covered a thrust range between 18% and 95% of maximum static rating—about 475 lb.—of the test system. Specific impulse averaged about 95% of theoretical value through the test range.

Both thrust termination and motor restart have been done during the one-paragraph test program. Based on these first runs, Ansel predicts cost-effective throttling ratios as high as 40:1.

Current testing is being done with fuel orifice plates simulating the throttle. Section of test points is not great and is situated largely in the use of experimental gases produced without benefit of high-rate production techniques.

Mechanical design studies of the throttle show that a simple device—perhaps no more elaborate than a variable profile—will handle the thrust control job.

### Low-Thrust Throttling

New phase of the Ansel program is aimed at low-thrust throttling and tailoring of specific propellants. Company will not specify other propellant composition, but says the performance level of the current combination is 215 sec specific impulse for expansion from 1,000 psi chamber pressure through a 16:1 nozzle. Test motor is built up from the Army's standard ballistic evaluation motor components, which feature cones 100 inches in diameter in series and one half-inch long. Two

of three cones and the throttling orifice are assembled with standard lead and machined plates for test articles.

Basic of the design is the separation of the propellant into separate tandem grains, one fuel-rich and the other motor-rich. The throttle is between the grains.

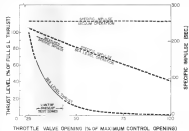
In firing, the fuel-rich grain is ignited and its exhaust is discharged through the nozzle and through the motor-rich grain, where further reaction occurs.

Closing the throttle results in increased chamber pressure and burning rate in the fuel-rich section, which increases the pressure in the motor chamber and thence the thrust.

First of the motor. First nozzle here is by reaction wave, fired by sudden opening of the throttle. Multi-plate system, protected by shoring plugs are used for restricting the motor.

### Orifice Grains

Development of the orifice grains is credited largely to the company's engineers experts, who decided to work backward from a pure orifice to an actual material containing not enough densimeter to keep it from exploding. They ended with a solid grain containing about 95% ammonium perchlorate. The grain can be slanted in the potting of fuel and will not explode



THRUSTLE VALVE OPENING (% OF MAXIMUM CONTROL OPENING)  
THROTTLING experiments covered thrust range between 18% and 95% of maximum rating.

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even when subjected to the shock of standard blasting rigs and metal pellet outbursts.

Consequently, the heating substance which makes the oxidizer safe to handle also becomes an active ingredient in the run and expansion of the porous matrix. Avoid such gases are made by conventional propellant, chemical or explosive technology.

Weight savings in the motor is rewarded by the spherical subap- first the throttle operates at a relatively low temperature blast of gas from the fuel-rich gas during burning. This means both decreased temperature and erosion, reducing the mechanical and material problems of the throttle design. Second, although the fuel-rich chamber operates at higher pressure and therefore requires a heavier shell case than steel, there is considerably more resistance to erosion than fuel. The weight penalty attached to the smaller section of the casing only.

Several factors the throttleable solid motor offers two advantages. First, thrust control, second, major improvements in motor performance—up to 100% and specific impulse—by using gases of materials naturally combustible if mixed in the same gas mixture.

### Director Chosen For British Consortium

London-British Space Development Co., a consortium of United Kingdom industrial firms previously interested in space for commercial use, will be headed by Sir Robert Bannister, director of Associated Electrical Industries and Associated Television, two of the member firms.

Top priority has been given to the development of proposals for use of space in the communications field, he said. In a broad sense, the consortium will "concentrate on and move British staff assume a significant role in space technology."

The group was formed earlier this year, and although its direction and objectives of initial work was opened by the Russian case in space flight, an achievement which caused criticism of Britain's lack of a space candidate.

Its technical committee includes the U.K.'s top scientists and technologists and is headed by C. K. C. Parize, leader of the de Havilland Blue Streak missile team.

Consortium members besides Associated Electrical Industries and Associated Television are British Telecommunications, Cable, Data, Radio, Hawker Siddeley Avionics, the Honeywell Co., Pye Telecommunications, Rank Television and Control Trust, and Rolls-Royce.

### ECCO CIRCUIT APPLICATIONS (No. 2 of a Series)

# N 7

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An N7 divider is a circuit that generates one output gate for each seven input pulses. If, for example, input pulses are applied at a 70 kpps rate, the circuit provides outputs at a 10 kpps rate. The ECCO N7 divider circuit described here can operate at input pulse rates up to 150 kpps.

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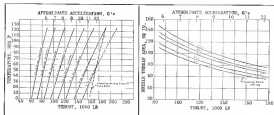




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Electromechanical systems by **Autonetics**  Division of North American Aviation



**THRUST AND ACCELERATION:** variations are possible with Megaburn del boosters using right different sizes of ignitable nozzle throat areas. Profile made on Megaburn del boosters (right) is calculated as providing three thrust and acceleration variations.

## Variable Rockets Studied for Test Sleds

Important savings in test and cost of rocket sled test programs can be achieved by development of variable thrust capability for the class of power plants, according to a Rocketdyne spokesman.

Utilization of variable thrust engines would permit use of two or three basic booster units covering a wide range of thrust levels. These can be adjusted or programmed in the field by test personnel to cover specific sled propulsion needs rather than requiring delivery of tailored boosters, or continuous expensive development of new motors. R. F. Cliffe, Solid Propulsion Operations, Rocketdyne, McGeorge, Tex., noted during a sponsored track symposium held at Chert Lake, Calif., recently.

### Load-Time Problem

Sled propulsion requirements for experimental track testing are seldom known with sufficient lead time—now in these sufficient money available, to develop or tailor a solid propellant booster to provide desired thrust-time programs, Cliffe stated.

Two promising basic methods of varying motor thrust are the variable nozzle throat area and one varying Cliffe reported.

A proven thrust level can be achieved by exactly matching a nozzle or nozzle throat area to the internal ballistic characteristics of the motor. With changeable nozzles, only particular thrust levels can be selected, because of the nature variety of nozzle area obtainable, he noted. But by inserting a tapered conical body or profile into the

throat of a conventional convergent-divergent nozzle, its variable throat area can be lowered that is used by positioning the profile along the flow axis—the profile nozzle providing selected variation in throat area and direct weight reduction two loading values.

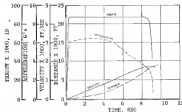
Rocketdyne has sponsored a research program that successfully demonstrated this motor as M-15 JATO motor. A conical profile was used in a conventional convergent-divergent nozzle, a theoretical design being installed in place of the standard nozzle and a larger convergent-divergent nozzle fired so that the basic motor would not have to be modified. Thrust levels with this variable 1,600-lb-thrust motor were

restricted in the range of 1,250 lb maximum to 750 lb minimum, corresponding to the maximum rate case pressure and minimum pressure for stable burning for the M-15.

This variable area nozzle design maintained a constant nozzle exit area so that if reduced throat area a greater expansion area ratio was obtained along with the increased chamber pressure.

### Command Throttling

Command throttling was directly related with a performance drop on the M-15 a stopped displacement controller being used to decrease, then increase, the thrust in steps. Thrust-time profile and velocity which correspond



**PRESSURE RELIEF VALVE** design (at maximum thrust value) would produce three acceleration, velocity and thrust distance time histories for Megaburn booster.

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APN	1.00	9.7	4000	7500
APN	47	10.0	4000	7500
APN	18	4.5	4000	4500
APT	2	4.8	3000	12000
APT	1	4.8	15000	12000
APT	26	1.9	15000	12000

ARMSTRONG



CHANGEABLE NOZZLE design for Megalox solid propellant solid booster could utilize throat inserts of solid steel facing into the standard nozzle nozzle expansion cone.

three level changes caused from a rapid change in thrust area followed by a slow change in thrust pressure.

A sharp change in thrust rate, with chamber pressure remaining essentially unchanged, caused thrust to change in the same direction as area change. This chamber pressure response to changes in thrust rate is a strong function of the line volume inside the nozzle cone as well as the rate of change of thrust area. These thrust transients can be reduced by close control of the rate of area change.

Close venting controls function in a similar manner, differing from the variable throat area system in having a fixed emergency divergent orifice to develop the throat and controlling chamber pressure by means of an upstream vent. Vents can be of two types: a manually preset vent or a venting pressure by means of controlled vents.

Either of these types can be rapidly or slowly varied position in the throat, combustion gases pass through the vent and then are discharged through two or more radially opposed ports to maintain side force at zero. Variable vented nozzles would discharge gases through ports that are electrically parallel to the axis motion. Throat motion is slower as the ports are sufficient in a nozzle.

#### Van Air Control

The vent area can be controlled by several methods. Hydrodynamic action or a perforated cone can be used.

The pressure relief valve principle can also be used in a venting system of throat marginate control. A compression spring or tension bar proportional to the desired chamber pressure, would keep the valve closed. As pressure area inside the rocket motor case, the valve opens at the desired pressure and maintains this level by holding off excess combustion gases until hot gas pressure-relief valves, capable of maintaining a preset value within 10% of desired level have been used successfully in numerous solid propellant boosters, Chiff noted.

Concluded in the discussion was

adaptation of a Rockwell 10-NB-10000 Megalox solid propellant motor which has been employed in solid tests at Redstone AFB. The solid motor's solid nozzle propellant used in this booster has a theoretical flame temperature of 2,600°F. would permit three control mechanisms to operate satisfactorily up to 25-sec without being vented, according to Chiff.

#### Changeable Nozzles

The usual method of controlling the production of the throat level of a Megalox is using changeable nozzles. Changeable nozzles for a booster that was used present a problem in field processing, he noted, but throat inserts can be built that will fire into a standard nozzle expansion cone.

Metal steel nozzles, machined for a particular throat area, can be used for inserts. But at intervals along the periphery of the nozzles used to reduce weight and facilitate handling, Chiff noted, throat inserts are fired into a recess in the entrance section of the exit cone. Eight sets of throat inserts would cover the range of adaptation required with an accuracy of approximately plus or minus 1%.

A port nozzle may also be used to venting preset throat levels, Chiff noted. A steel plate, mounted on a thrust axis, with a fixed throat diameter, could be driven by means of gas from the tank of the air closure. A differential valve, attached to the porting drive would indicate the position of the plate on the nozzle throat. With the plate actuated fully upstream, the throat area is maximum, extended fully downstream, the throat area is minimum. Between these extremes there would be indicated variation of throat level adjustment.

Relatively low flame temperature of the propellant and burning rate of less than 15 sec permits use of solid steel in the nozzle and nozzle profile structure. Supports could be fabricated from solid steel, welded, stress-relieved and air

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divided for alignment. A dry lubricant such as Molykote would be used on threads and girths.

One initially vented, spring loaded piston, which valve described by Chiffre would be attached to the aft head of the booster to control flow by large diameter piston movement. Piston is held at a level by controlling the compression force applied to a large spring which acts as a control point to vent the chamber whenever burning tends to produce an overpressure.

Continuously varying the thrust of a booster during a test can be reason of a variable area nozzle is feasible, according to experimental work of Rocket & Jet's Solid Propellant Operations, Mr. Genger, Inc. A control system can be incorporated into the variable area nozzle design which automatically senses and corrects, compensates for such a, used valves and reproduces the pulse to increase or decrease the thrust in desired.

A problem in this system is the possibility of undesirable transient thrust peaks and valleys accompanying rapid changes in thrust area, Chiffre pointed out. Because of its size and mass, the pulse on the Megalodon-type booster should be pre-positioned for desired rapid acceleration. These pulse movement can be tested to gradual changes and these undesirable transients can be avoided.

As an alternate method of varying thrust magnitude, a sleeve over a tube mounted on the booster aft head could be utilized, providing a variable vent area by rotating the sleeve to align openings through that port into a plenum from which a gas flows through nozzle or vented area. Automatic thrust control is provided by using a hot gas sensor to rotate the sleeve to the desired vent area, the working gas for the servo motor being tapped directly from the booster chamber.

## Japan to Fire Monkey To 600-mi. Altitude

Tokyo—Japanese space and medical scientists are planning to launch a rocket with a trained monkey aboard.

The Environmental Medicine Research Institute of Nagoya University has begun medical screening of monkeys at the request of the Tokyo University Institute of Industrial Science to study effects of space flight on cardiovascular and electrocardiogram of live animals.

A live female monkey less than one year old will be placed in a low-pressure chamber supplied with oxygen when the Tokyo University Institute launches a Lambda model to an altitude of about 600 mi. from its new launching site on the uninhabited island of Kurehara this fall.

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## PRODUCTION BRIEFING

Borden Corp.'s Products Division, South Bend, Ind., will develop a parashaped nose gun for the Decca Star unmanned aerial glider under a \$75,000 subcontract from Boeing Co. The gun will be retractable and be fitted on underside of fuselage. Boring is scheduled to award another contract to industry to develop an experimental air loading gun.

Marquardt Corp. has been awarded a \$4 million Air Force contract for additional research in the development of Project Fish nuclear target engine. Marquardt is coordinating its effort with the University of California Lawrence Radiation Laboratory, which will demonstrate Phase reactor feasibility.

Wyle Laboratories, Inc., will perform vibration testing on the Skellard air-launched ballistic missile rocket motor for Aerojet-General Corp. Testing will be at Wyle's Norco, Calif., headquarters site.

Reul Industries, Inc.'s Reul Jet Division, Alhambra, Calif., will supply specialized containers for Pelox missiles under a \$750,000 contract from Hughes Aircraft Co.

Conaga Electronics Corp. will build five airborne timing systems for the Air Force Missile Test Center, Patrick AFB, under a \$170,000 contract.

American Electronics, Inc.'s Precision Power Division, Fullerton, Calif., will produce electro power units and power supplies for installation at underground Minuteman launch sites under two contracts awarded by Boeing Co. Initial power units contract is estimated at more than \$600,000. The second unit will power supplies award at more than \$160,000.

Douglas Aircraft Co. has completed a new \$410,000 liquid hydrogen laboratory at Santa Monica, Calif., where research will supplement its liquid hydrogen propellant testing and loading experiments at Douglas' Sacramento field station. It also will permit a wide range of testing for Strata S-IV components at extreme low temperatures, including evaluation of cold bearing systems for fuel pressurization for the S-IV. Facility capabilities include burst testing at up to 20,000 psi and burst rate tests of 2,000 gpm at pressures up to 175 psi.

Pentacore Industries, Inc., has received a \$975,000 contract from Navy's Bureau of Weapons to design and manufacture 300-gal external gravity-storable fuel tanks for the carrier-based Douglas A-7B.

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
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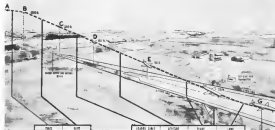
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BRITISH ILS automatic landing system, now being installed at Atlanta City Air Terminal, Atlanta, is one of several automatic landing systems which require reduced transition from ILS beam to another criteria at extremely low altitude. This has prompted efforts to think of improvements in ILS which would permit safe automatic approaches to below 100 ft where pilot could then use high-intensity approach and runway lights to execute regular manual descent and landing.

## ILS May Handle Automatic Blind Landing

By Philip J. Klaus

Washington—There is a growing air-line industry belief that the long-sought goal of all-weather operations may come from improvements in existing equipment and facilities rather than from use of the several automatic landing systems now under development or test.

Evidence to substantiate or negate this view should come during the next several years as the industry gains experience in the use of automatic pilots and approach couplers, new approach lighting and the improved directional location which the Federal Aviation Agency is installing at 10 airports.

Recent under-the-hood talks by the American, World Airways and Boeing suggest that it may be feasible to make automatic (single) ILS approaches down to altitudes below 100 ft in jet transports. At these altitudes, direct transition to high-intensity approach lights may be possible, permitting the pilot to make a manual descent. Recent flight tests suggest that the acceleration characteristics of gyrocompasses and turboshaft engines are sufficiently good to permit a jet transport to short-land automatically on an automatic approach at

altitudes of 50 ft and perhaps lower.

There are several reasons why the airlines would prefer to use the present ILS with direct transition to visual landing if this proves feasible, instead of the installation of separate new automatic landing systems. However, as details of such approach development and test of automatic landing systems • One less transition. All of the auto-

matic landing systems under development require the use of ILS for the approach, which means a transition from ILS to the landing system at relatively low altitude, and a transition seconds later in the pilot to visual contact. Few systems like the British BLS-1, now being installed by FAA at Atlanta City Air Terminal (AW Apr. 24 p. 60) and the Autoland APN-114



NEW DIRECTIONAL location system, employing slotted wingtip area, provides more accurate and more stable ILS location which should permit lower altitude instrument approaches even at airports with adverse sight. New system, now installed at Moultrie Field, Tex., is planned for installation at 10 other airports.



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smooth descent, the actual transition from ILS takes place at an altitude of only 50-100 ft.

• **ILS is precise.** Low approach using ILS has the advantage that a pilot can check operation of the beam and his approach complex while the aircraft is above 1,000 ft. altitude. The pilot cannot positively check the operation of the automatic landing system without equipment until transition is made to the status of low altitude.

• **No additional equipment.** If ILS is combined with auto-approach complex, one successfully permit an transport approaches down to 100 ft or less, allowing direct transition to visual contact, no additional overhead or ground-based facilities would be required.

#### Problems for Improvement

The recent action of many airlines in closing up design, maintenance and major problems in their jet transport autopilot, approach complex and flight direction is an effort to obtain FAA authorization for lower jet transport operations. It is expected to produce a chain reaction which will do much to improve the industry's all-weather operations.

If FAA grants authorization for lower jet transport operations, it is expected to do so on a selective basis for specific airports, where ILS and instrument facilities are adequate, and for those airlines whose auto-approach complex reliability and pilot proficiency permits such action.

Furthermore, where approach complex and flight direction were questioned only in connection of convenience, there was little economic incentive to the carriers to meet heavily in the required maintenance and pilot training. But if one carrier is able to execute jet transport schedules under 100 ft. it is minimum while its competitor is forced to cancel for lack of work in heavy weather. The latter will have considerable economic incentive to make the required investment in auto-approach complex maintenance and pilot training, otherwise believe.

Programs also will be generated for the FAA to improve the quality of ILS facilities at major airports. As long as instrument approaches are made routinely where the known pilot is shown in noise or fog on the ILS system, based on previous experience, there is little pressure to improve the facilities.

But as auto-approach complex is less flexible and more demanding of good quality ILS because the FAA can expect to be mandated with compliance or adequate installations over the airlines start to make widespread use of approach complex.

Even jet transport manufacturers

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We quote, in part, from **BOEING NEWS**, January 12, 1961: "The design to install the entire network (TRANSACTION System) came as a result of successful tests conducted . . . by Boeing employees and representatives of Stromberg, manufacturer of the entire system.

"Types of information that employees will 'feed' to the data collecting nerve center will include personal attendance data and detailed information of time spent on specific job assignments.

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"Some of the advantages of the system include the following:

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2. Greater accuracy in reports by reducing the margin of error caused through extra handling."

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a tape record of hot's existence for subsequent study. But usually once police determine just before digging, such an attempt is too late before being so this way.

• **New Superconductor Repetition**—New alloys made of niobium and zirconium which become superconducting at temperatures higher than any other known alloy, were disclosed by Dr. B. T. Matthias of Bell Telephone Laboratories at recent meeting of the American Physical Society. The new alloys, which become superconducting at temperature of 10K, also are very ductile, possessing an ethereal characteristic of either niobium or superconductor. Another BTL scientist, Dr. J. E. Koster, reported compounds which suggest that superconducting alloy may be able to remain superconducting in the presence of fields as high as 200,000 Gauss at temperatures of about 4K.

• **Signed on the Dotted Line**—Major contract awards recently announced by aviation manufacturers include the following:

• **Balluff Instrument, Inc.**, Waltham, Mass., \$13 million contract for development and production engineering of infrared detectors for use on M-16A1 night vision system, from Lockheed Martin and Sperry Division.

• **Collins Radio Co.**, Cedar Rapids, Iowa, \$400,000 contract from Eastern Air Lines for FD-100 integrated flight system and DF-100 automatic flight system for EAL's new Boeing 720 jet transports. Collins also reports a \$695,000 contract from Sud Aviation for airborne communications equipment for Caravelle jet transports.

• **International Electronic Corp.**, \$150,000 contract for improved short-range communication from Rome Air Development Center, for converting wireless radio data into narrow-band information that can be transmitted over telephone lines.

• **Rescue Corp.**, Systems Division, San Jose, Calif., a definite contract for \$172 million from the Army for Project Advent communications satellite, awarded for a 24-hr worldwide operational orbit.

• **SoundRecorder Corp.**, North Haven, Conn., \$918,227 contract for magnetic tape recording equipment from the Federal Aviation Agency. Equipment will be capable of recording 10 channels of audio communications simultaneously, only 17 in. on one-inch wide magnetic tape. Company sells for 98 recorders and 40 reproducers.

• **General Telephone & Electronic Corp.**, Systems Division, Buffalo, N. Y., \$5 million Navy contract for production of communications systems for nuclear-powered Polaris submarines.



### Reading Machine

Electronic reading machine can now type written copy containing alphanumeric data into and presentation at rate of 21 lines per second, convert typed copy into 6-level fluorescent code or 6-level infrared code at rate of 240 characters per second. Machine also is available with magnetic tape output. Machine is expected to find use in computer data with automatic computer translation projects and as a means of rapid entry of printed information into digital computers. Manufacturer: Raytheon Manufacturing Co., Norfolk Heights, Mass.

### Tri-Dimensional Radars Use Polarized Glasses

Pellertan, Calif.—Hughes Aircraft Co. has developed a three-dimensional radar presentation and based on the technology using polarized glasses to compensate total picture of the operator read by the screen a few years ago.

The unit was developed with cooperation from and has been tested by the Navy. Hughes officials think it may have a role in air traffic control since it can give a controller the ability to see if there is a vertical separation between aircraft. Storage tubes are used in the system so that a continuous plot of aircraft tracks can be kept on the scope for as long as wanted.

At yet no accurate tests have been run to determine the ability of operators to estimate altitude differences with the system or to learn how troublesome overhead would be to operators equipped with the system. Hughes officials say each test will be made.

The minimum "apparent" vertical dimension which can be perceived by controlling binocular parallax is about a foot. Scale can be varied to make the one foot represent any maximum altitude. For air traffic control applications, the maximum altitude would probably be no more than 75,000 ft. and as less than 5,000 ft.

A few questions to be answered by operator tests will be the horizontal distance between targets at which a specified resolution of altitude separation can be detected.

### NEW AVIONIC PRODUCTS

• **Message system expansion**, Model 1012, for testing or evaluating complete message system during Mission development in the production testing. Design operates with address-to-address write tubes which are continuously variable from 1 to 180 microseconds and can accommodate random access or serial buffer memories with capacities up to 16,384 words and word length up to 48 bits. Manufacturer: Raytheon Corp., "A" and Courtland Street, Philadelphia 20, Pa.



• **Minimum system with sector switch** automatically switches to rich and close circuit when residual ratio is postulated 70 deg. for other desired values from its electrical arm. The switching capability adds only 0.5 in. to length of 3-in. x 5-in. Device weighs 3 oz., measures 0.75 in. dia. x 1.7 in. long. Manufacturer: Collins Precision Products, 5018 Shaw Road, Dorset Hts., Pa.



• **Microammeter**, zero-to-100, mounted on a 1/2 x 1/2 in. plate, is available in stock of 1 to 10,000 ohms with power ratings of 0.07 watts. Manufacturer: Raytheon Corp., 155 Ben Mifflin Road, Yorkton, N. Y.

• **Transmitter**, UHF/VHF, become transmitter, Model 1012, for use in most air weight only 14 lb., measures approximately 14 x 14 x 14 in. Power output is 250 watt at 121.5 mc.



• **Minimum variable-speed transmission**, measuring 2 x 2 1/2 x 15 in., is a compact planetary system with the non rotating member a twisted ring that engages teeth rather than varying diameter. Capable of handling up to 1 hp., device is available in three types: one delivers all speeds from any desired maximum down to zero, a second delivers speeds from maximum to zero and full reverse without change of input direction. The third can be mounted to give output speeds that vary approximately 10% from a given input speed. Manufacturer: Gishkin Transmission, Inc., Micromechanics Park, Wis.



• **UHF transmitter**, which is crystal controlled, is available Class A2 by a 1,000 cps. tone, approximately 100 watts per second. Manufacturer: General Aviation Corp. 1190 W. Jefferson Blvd., Culver City, Calif.

...ad astra  
per aspera...

## MAN INTO SPACE!

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1-2

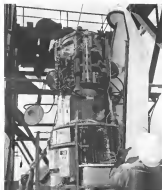
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Data gathering equipment of the Blue Scout is checked at Aeronautics Division of Ford Motor Co.'s Newport Beach, Calif. facility, before being mounted on upper section of vehicle. Aeronautics is prime contractor for Blue Scout.

## Blue Scout Gathers Space Data

Blue Scout II nosecone vehicle launched by Air Force personnel needed guidance and control system components. Recoverable capsule was lost, but data from two instruments was teleported to ground stations. Below, Air Force personnel place last shields on nose section.



Blue Scout II launches Air Force space probe 18 miles on launch pad at Cape Canaveral, Fla. Vehicle was launched Apr. 12 (AW Apr. 17 p. 37) but 90-lb recoverable capsule was lost.

# WITH MAN IN SPACE



NATIONAL AIRCRAFT CORPORATION, Lockheed Field, St. Louis, Missouri, is prime contractor for the Mercury Capsule, under the direction of the National Aeronautics and Space Administration. Photo shows capsule under test in the FREDONA VII and in special launch.

The *Mercury* May 5, 1961, 10:34 AM EDT. The man: Commander Alan B. Shepard, Jr., USN, Astronaut. The *Mercury* Capsule with man as a down range step into space. The metal structure for a combination of strength and lightweight in the vehicle's double wall stringer construction.

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sales manager \$18,000 salary, no stock;  
sales assistant E. G. Anderson, \$16,  
production assistant W. J. Johnson, \$16,  
190 electrician assistant W. H. & S. Nelson  
\$7, vice president-general operations, \$24,  
\$18 salary, no stock or options; E. G.  
Anderson, assistant treasurer, \$14,000  
salary, no stock, 10% ownership.

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**Katherine Ashmore**—B. W. Stern, *Executive* 267 published \$15,000 salary. 10,000 shares of common stock. 19,740 deposits. B. W. Stern has provided maintenance and cleanup operations. \$11,040 salary. 1,000 shares of common stock. 19,740 deposits. B. W. Stern is the president and general manager. (Stern, Inc., 20 1980) \$12,000 salary. No stock. 19,740 deposits. P. L. Schneider, the president, has received \$10,700 salary and shares of common stock. 10,000 shares. 1. 1. General

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about 20 shares of common and with shares of 14%, provided that 14% represents 5% of the net proceeds under the 1993 equity plan. The 1993 equity plan is a 10-year plan, with 10% of the shares of common and with shares of 14%, provided that 14% represents 5% of the net proceeds under the 1993 equity plan. The 1993 equity plan is a 10-year plan, with 10% of the shares of common and with shares of 14%, provided that 14% represents 5% of the net proceeds under the 1993 equity plan.

[illegible]

**W. A. MacKay**, director, no salary; 7,600 shares of common stock. Billie Suzanne, an brother or indirect compensation. C. B. Wiggins, director, no salary, no stock. J. T. Ferguson, an brother or indirect compensation. A. Pelton, director, no salary, no stock. Shares of common and 8,000 shares of 10% preferred stock. 8,000 shares of com-

and 1,001 sheets of 11% preferred stock in the name of where 2150 corporate as home or halfed composition. C. F. Byrle director no salary 8000 shares of common and 1100 shares of 11% preferred stock. 1000 shares no home or halfed composition.



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and facilities. \$11,110 salary on stock, \$2,222 expense. \$136 bonus and dividend compensation. E. F. Smith, national vice president and director national in charge. Journal Register, 170-174 N. LaSalle, 10 shares of common stock, \$211 expense, \$1,222 bonus and dividend compensation. E. F. Smith, vice president-nominations, 100-10000, \$10,000 salary on stock, \$2,222 expense, \$136 bonus and dividend compensation.

[illegible]

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plants in the New York-Cincinnati area into one. Norwalk and General Tech, General said, "we expected a certain amount of attrition among our technical personnel. Surprisingly, this didn't happen. We did lose some but retained help, but as large as the size people we wanted." Norwalk now employs about 1,100 people, approximately one-third of that number being located at Norwalk, and this compares with Norwalk's 1,000 personnel strength in 1955.

Agreed to fill a gap in United's technological spectrum and to provide United Aircraft Corp. with an entry into the growing electronics color market. Norwalk today is gradually entering into navigation, bandwidth, radiofrequency and guidance systems, etc. outside, as color television systems (other than vertical) apply gas pressure remote speed components and, in the non-color Color View phase, into color control systems and video timing and educational storage machines.

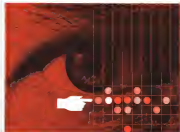
In one major field of interest, General said, "we wanted to be led at the electronics piece contractor on even new project that comes along, whether it is an aircraft, space or electronic system." In another area, Norwalk could be in parallel in satellites and videorecorders in further subcontracting.

No longer exclusive oriented, Norwalk is presently working on various projects for the Air Force, Navy, National Aeronautics and Space Administration, Federal Aviation Agency and other governmental organizations.

Norwalk is currently an associate prime contractor on two aircraft (General Dynamics F-111 and Douglas A-12) for navigation and bandwidth systems. As a subcontractor, the company has developed for the Navy a control analog which displays a submarine's position relative to bottom and surface, pitch roll, heading and speed, all on a single screen before the helmsman. For the Air Force, Norwalk has built a reference on-map computer system, which automatically selects on aerial reconnaissance source criteria to produce overlapping consecutive photographs and a film union theodolite for aerial tracking.

Last year, the company secured a two-month study contract from the Maritime Commission to determine the feasibility and economics of a fully-automated merchant ship. The study covered the requirements and possible designs of command-and-control computer, navigation and electronic command systems and, as performed by two other United Aircraft Divisions, Pratt & Whitney and Hamilton Standard, propulsion and control systems.

Under contract, reportedly, Norwalk has produced a small 22 ft. x 11 ft. attitude inertial platform and it is



**THINK, ACT!** How will crews of aerospace vehicles perform under long periods of stress and confinement? Lockheed/Georgia finds accurate answers in the crew makeup section of its Behavioral Research Lab—just one of the many capabilities of its highly qualified Human Factors Research Group. **LOCKHEED/GEORGIA**

Marina, Georgia

## PROBLEMATICAL RECREATIONS 66



Ann, Barbara, Carol, and Dorothy are members of the Delicacy Club. Every part of members is together as one and only one committee has exactly 3 members. What is the smallest possible total membership, and how many committees are there?

—Continued

Now being used by many manufacturers is our new Microwave Unit for cooking. Most of the unit is the newly developed L-3100, an advanced CW magnetron that includes full operating power in less than 6 seconds! Cooking time is equally speedily struck modern, 3.3 mm. Address questions regarding Litton tube advances to Electron Tube Division, San Carlos, California.

**ANSWER TO LAST WEEK'S PROBLEM:** On the average, the entire set of 52 cards will be obtained in  $52 \left( \frac{1}{52} + \frac{1}{51} + \dots + \frac{1}{2} + \frac{1}{2} + 1 \right)$  trials. Hence the average number of trials will be  $52 \left( \frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{51} + \frac{1}{52} \right)$ , and since we must buy an integral number of signature packets the number will be 236.

**LITTON INDUSTRIES, INC.**  
Beverly Hills, California

understood that the company has recently proposed the unit to a major agency—presumably the Air Force—for satellite applications.

Other current company projects include a pressure sensing system for jet engines, remote monitoring wheels for Midas and Samos satellites (AW Jan. 24, p. 23) and an angular measurement device called Miscoon, which is reported to be available to 3 out of 4.

Norden does not plan to compete with electronic component manufacturers. "We will continue to make those components which are necessary for systems we are building," said Aspen, "as well as those for which we have an established market, like our analog-digital converter. But aside from that, we're staying out of the component business."

Again only to the extent of analyzing its own needs, Norden is delving into microconcentration and microfilm technology. "If this and work in laser can lead to component miniaturization," Aspen said, "they will, in effect, wind up supplying us with completed units. From there it would be but the next step to assemble the entire unit. So, we do it ourselves."

The Costa Mesa department of Norden last test delivered an electronic video-taping system to Los Angeles County. The machine, which can store and reproduce 400 video per minute, was approved in January this year, after extensive testing, and will be used more and more in California, according to the state's Commission on Voting Machines and Vote Tallying Devices.

## New Offerings

Keweenaw Chemical Co., Benton, N. Y., boron in a variety of fields at chemistry, and more specifically in the field of the less familiar metals and their compounds, including titanium, columbium, niobium, zirconium, zirconium, hafnium, tantalum, niobium and boron, some of which are essential in nuclear alloys produced by the company. It also has done research work on gallium, selenium, tellurium and other semiconductor compounds and has set up pilot plant operations to produce some of these materials. Offering is \$3,500,000 of 40% convertible subordinated debentures due 1978, and 37,282 shares of common stock available upon exercise of warrants. Debentures are to be offered for subscription by stockholders at 180% of principal amount, and at the rate of \$100 principal amount of debentures for each 15 shares held, stated date and underwriting terms to be supplied by underwriter. Proceeds will be used for the refinement of bulk materials, for expansion of existing facilities used for production of titanium, columbium, niobium alloys and other prod-

ucts currently being produced. Balance will be added to the general funds of the company to be available for general working capital.

Potter Instrument Company, Inc., Plattsburgh, N. Y., engaged in the design, manufacture and sale of electronic data processing equipment, including high speed digital magnetic tape drive units and various other products used in electronic computers, information controls and data reduction equipment and include subassembly systems. Offering is \$10,000 shares of common stock, for public sale at \$10 per share on an all or none basis, 190,000 shares for sale by the company and 20,000 outstanding shares by John F. Potter, president and board chairman. Pro rata of the company's stock will be used to effect bank loans incurred to finance accounts receivable and inventories, and to cover interest payments of these loans, to continue the company's product development and tooling. Balance will be added to working capital and used primarily for additional research and development.

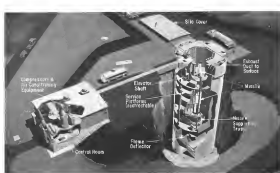
Selentine Corp., Minneapolis, N. Y., engaged primarily in the development, manufacture and sale of electronic data processing and subassembly for use in electronic and electrical equipment, as craft, remote, communication and data-processing industries. Offering is 331,000 shares of common stock, 100,000 shares for public sale by the company, 100,000 outstanding shares by William Selentine, company president, and 23,000 outstanding shares by another stockholder. Offering price and underwriting terms to be supplied by underwriter. Proceeds of the company's sale will be used to repay a bank loan incurred in 1959 as the acquisition of a former stockholder's interest, and to pay the balance due to such stockholder in return of such acquisition. Balance will be used to expand plant facilities, purchase additional machinery.

Wayne-George Corp., Boston, Mass., engaged in the design, development and manufacture of digital translators, also known as analog-to-digital modems, and in research and development of new types of digital modems to incorporate and expand its line of products. Offering is \$2,000 shares of common stock, 50,000 shares for public sale by the company and 20,000 outstanding shares by George H. Wayne, president and principal stockholder. Offering to be made on an all or none basis, offering price and underwriting terms to be supplied by underwriter. Proceeds of the company's sale will be used for payment of a note (1978 \$500,000), for machine tools, laboratory test and measuring instruments and new plant facilities for

company-sponsored research and development and expansion of its staff of engineers and technicians due to increase for working capital, of which up to \$100,000 may be used to acquire real-estate.

Microwave Associates, Inc., Burlington, Mass., bulk of the company's design and production effort has been devoted to supplying manufacturers of radar and telecommunications systems with specialized components and accessories associated with the generation, reception, switching and measurement of microwave radio energy. Offering is 240,000 outstanding shares of common stock for public sale by the holders annual, initial public offering price will be related to the current market price of the stock on the American Stock Exchange at the time of the offering. Underwriting terms to be supplied by underwriter.

Turn World Airlines, Inc., New York, N. Y., engaged in transcontinental and international air transportation. Offering is \$111,215,990 of 41% subordinated income debentures, due 1978, and warrants for the purchase of common stock. TWA proposes to offer holders of its common stock the right to subscribe to such debentures, with common stock, purchase warrants, at the rate of \$100 principal amount of debentures for each 100 shares held. Terms of the warrants, record date for subscription, and subscription price to be supplied by underwriter. Under an agreement between TWA and Hughes Tool Co., the beneficial owner of voting trust certificates issued with respect to 5,221,368 shares (78.31%) of the company's outstanding common stock, Hughes Tool Co. may, at its option, accept purchase, all or part of the debentures not purchased under the subscription offer, and has agreed to purchase such number of debentures at will, with debentures purchased by it and others under an offer, provided the company with at least \$100,000,000. TWA paid in part for the cost of its security by the manner in Hughes Tool Co. at a 64% interest subordinated note in the amount of \$100,000,000. As part of that transaction and in connection with its issuance of equipment mortgage notes, the company agreed to make this debenture offering to stockholders and to use the proceeds thereof to the extent required, to pay such interest subordinated note at 100% of principal amount thereof to the extent such note is not applied directly by Hughes Tool Co. to purchase debentures. Accordingly, proceeds from the debenture sale will be applied to the payment of said note, any balance from the sale will be used by TWA for general corporate needs.



Apoll's design shows construction of the launch test facility, which test Martin Titan underground firing was made (AW May 8, p. 30). Designed and built by Ralph M. Pearson Co., the plant used 3.0 inch diameter cables.

## Titan I Underground Silo Launch Firing Meets All Air Force Test Objectives

Martin Titan is shown lift-off from Vandenberg Air Force Base underground silo in sequential photos. Purpose of the Titan I firing was to determine the capability of the 140-ft deep concrete tube to launch the missile, as well as to adjust the mode to the stress required in the firing. Testimony states made by the Air Force's Ballistic Systems Division, Ballistic Systems Laboratory, "Launch/Control's Advanced Research Division, which made 140-ft scale model test firings, concluded in the controlled mode launch. Air Force described the flight as meeting all test objectives."



## Total human system analysis is now feasible through electronics

**Problem:** To determine the condition of a living system by analyzing relationships of body functions in many forms, including movement, pressure, flow rate, temperature, electrical potential.

**Approach:** Development of readily compatible instrumentation to retrieve, store and analyze such information, based on the latest technological developments.

**Result:** Medical research can correlate and compare every body function with a speed and accuracy not possible by any other means.

Amper, an established leader in magnetic tape instrumentation, provides a basic key to the problems of measuring, computing and analyzing medical data. Amper and its equipment currently play an active role in over 150 medical research programs, including neurophysiological, psychophysiological, biomechanical, electrocardiographic and cardiovascular analysis. Specific emphasis has been placed on compatibility with the latest data reduction and computing devices.

More information on this work is now available from Amper to help establish the common meeting ground for medicine and electronics. Write:

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## BUSINESS FLYING



**BEAGLE-AIREDALE TERRIER** is civil version of the Auster 54. It used by British navy. Long exhaust pipe means water exhaust has been added for naval operations. Features include retractable-type upholstery and also extensive cabin soundproofing.

## Airedale, Terrier Unveiled at British Show

By Herbert J. Coleman

Covering, Eng.—Beagle A109 Airedale and Beagle-Auster Terrier bowed into international business plane competition at the W. S. Shackleton air show here.

Beagle-British Executive and General Systems Ltd. plans to sell the eight (all) aircraft landing gear Airedale for \$12,000. Scheduled to come off the production line at Berris this month the Airedale aircraft will hit a 16-per-month production rate (AWN Mar. 3, p. 23).

Beagle is also planning to expand into the twin engine field and expects to sell a completely new aircraft at the Edinburgh show in September.

### A61 Terrier

The other airplane designated Beagle-Auster A61 Terrier also shows its first time in a two-to-three seat version and sport version developed from the Auster Mark 6 series now in service with the British army. It sells for \$4,500 in the standard configuration.

The Airedale is a refinement of the Auster series of high wing aircraft with front and rear doors and a separate baggage door, wheelie controls replacing the former stick, and tireless gear with a movable nose wheel. Staining, appearance matches have been reduced to the soul. It will compete in the U.K. directly with the Cessna 175 and, when production commitments allow, the new Piper Cherokee. Four places now being built at Vero Beach, Fla.

Airedale powerplant is a 140-hp Lycoming O-160 engine driving a McCauley constant speed metal propeller. Cruise speed is said to be better than 190 mph and stall-on range is 1,010 stat mi., with 6 in. endurance.

Engine includes an exhaust exhaust system to drive a small amount of direct exhaust into a duct to reduce backpressure in ducts. System was first designed for Rolls-Royce Merlin engines in World War II.

Wingspan is 35 ft., length is 25 ft. 10 in., and height is 9 ft. 2 in. Wing area is 194.5 ft. and gross weight is 2,750 lb. Provision has been made for

a fuel capacity of 52 gal. to give the maximum range. Maximum fuel load is 52 gal. for a 570-mph range. At maximum cruise setting, this works out to a consumption of 61 gph.

### Small Speed

Beagle says the Airedale will take off clearing a 50-ft obstacle in 95 sec and has a service ceiling of 14,000 ft. Initial rate of climb is 710 fpm. 1,140 fpm stall speed is 52 mph.

Plastic has been fitted with slatted flaps for improved short field takeoff and landing characteristics. Construction features extensive use of plastic for



**TERRIER** cockpit as displayed at Shackleton air show is shown in closing.



# 91 OUT OF 96

OF THE JET-EQUIPPED AIRLINES IN THE FREE WORLD USE ESSO TURBO OILS. THIS REMARKABLE ACCEPTANCE IS INOICATIVE OF THE HIGH QUALITY THAT GOES INTO ALL ESSO AVIATION PRODUCTS. NEXT TIME YOU LAND, TAXI OVER TO THE ESSO SIGN.

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HUMBLE OIL & REFINING COMPANY



CESSNA LIMPUP at Stockdon air show's Aviation Weekend includes, from left, the 372, 319F, 175 and 180. Cessna influence on Amdale is evidenced by swept tail. Beagle says the Amdale was designed with FAA requirements in mind.

wheel bearings, window moldings, wing tips, tail fairings and doors for "strapping" fuselage will be standard equipment.

Although the Amdale was developed from the basic Auster design, Beagle says only 150 days elapsed from the drawing board to first flight. Detailed Auster jigs have been modified for the production line.

U. S. influence on the Amdale was most evident in the swept tail design spearheaded in the highplane field by Cessna Aircraft. Peter Macneil, engineering director of Beagle, said the plane was designed with Federal Aviation Agency requirements in mind, and that eventually it may be offered for sale in the U. S. but that no such plans are premature at the moment.

In quiet sale of Beagle aircraft, Macneil considers a selling up Beagle 75, River 440, a single-seater sailplane which will average less than over long-range, growth of up to five years, and multi-engine purchases on long-term contracts. Details are still being worked out.

The 361, 362, the other Beagle entry, is powered by a 145-hp de Havilland Gipsy Major 10 engine. Cruise speed is 118 mph and the plane remains in demand as a touring school and club activities. Features include automatic type upholstery and trim and extensive soundproofing of the cabin. In addition, Beagle has extended the engine compartment and added a muffler for further suppression of sound.

Total gross weight is 2,590 lb. and has a 22-gal fuel supply. Maximum speed is 123 mph and range is 615 mi. The plane uses a 1041, altitude is 775 ft. and has an initial climb rate of 810 fpm.

Dimensions are span, 36 ft., length 27 ft. 3 in., height 8 ft. 11 in., and wing area 164 sq. ft. Engine uses a Favory Reed metal fixed pitch propeller.

The two British light aircraft were displayed in an international roster in closing entries from Germany, Czechoslovakia, Italy, France and the United States at Stockdon's Aviation Week, well-suited to light and business planes.

The event drew more than 4,000 persons to observe—and possibly buy—48 odd makes of planes ranging from the Cessna Goldwing to the French Jodel Maulin. Most British designs were represented and first official sale was made by Short Brothers & Harland, Beagle dealers who sold a Queen Air to British Gas Co., Ltd.

#### Successful Show

Stockdon said the fourth annual show was the most successful yet and demonstrated a growing interest in models of both private and club flying, along with heavier business planes in the multi-engine class. Stockdon has purchased the first six Beagle Amdale Aerobics of the production lot, for sale in U. S.

Indication of British lightplane activity, he noted, was the fact that there were 1,000 aircraft movements during the five-day show, despite inclement weather. On the closing day, there were 700 landings and takeoffs. At a peak of 90 cars, more than 142 pilots, with roughly half those air licenses refreshing his ratings.

In the larger classes, a Cessna

owned by Gresh shipping magazine Stephen Norcross was on display for one day, and the Aero 745 twin turboprop No. 1 prototype made a short flight demonstration. Plans for a drawing of a Fokker F-27 and by Helmer's Peter Bernhardt were canceled at the last minute due to assignment of the plane elsewhere.

In the lighter classes, the show was captured by the Amdale which made its initial flight only two weeks previous, after Ronald Foster, test pilot, made a short test run. It had flown only 4 hr. prior to the Aviation Weekend, because Beagle was forced to ground the aircraft for painting and final trim.

Berth's breakthrough in the light aircraft field was discussed at the next, Royal Air Force expansion was noted by Tim Vignam, of Vignam Aviation, Ltd., Redditch, British Paper dealer and one of the prime movers in formation of a new association designed to promote British flying.

The group, now in its final stages of formation, is the Business Aircraft Users Assn., headed by M. A. H. Bellhouse, chairman of Beagle and deputy chairman of Pressed Steel Co. Cowley, maker which formed Beagle in a subsidiary. Activities of the association was an outgrowth of studies by the Business Aircraft Advisory Committee of the Royal Aeronautical Club, which was headed by Vignam.

The new associations will coordinate all phases of business aviation and among initial projects will be the selection of a Central London Airport, used particularly at this phase. First move probably will be toward improving of London-Croydon, closed 16 months ago and now used for auto storage, although removal and bridges are still available.

At present, business aircraft can fly within a 1 hr. drive of downtown

#### Airedale Price

Beagle-Amdale Aerobics are priced at \$12,000. The conventional gas-powered version will be marketed by about \$4,500. Amdale 700's original price points for the growth of \$5,500 and \$1,900 (AW May 6, p. 28) respectively more recent.



Wing & Propeller photograph taken from NASA's Gemini 11 during capsule approach to Earth. Shown's view of entire contents of the United States. Airedale's view through Ford-Elmer periscope covered 100 miles.

## "On the periscope. What a beautiful view!"

An eye for an astronaut—designed and built by Perkin-Elmer . . . a highly precise optical system that provides a 175° clear view of the earth below, with the option to superimpose a magnified 19° view in the center of the periscope display screen . . . lightweight, yet rugged to withstand a journey into space and return.

More than just a viewer, the periscope supplies vital navigational data: drift, pitch, roll, true vertical, retrograde angle. The periscope also serves as an "optical altimeter" since laser-altitude altimeters cannot function in space. Following Mercury from the ground was another P-E system—the 500-mile focal length RGTI. This telescopic tracker in need to photographically record the behavior of missiles in flight.

The unique periscope for the NASA Mercury capsule is

no example of Perkin-Elmer capabilities in precision optics and electronics—and the experience it can employ to meet the challenge of space-age instrumentation. Other examples: guidance alignment equipment for missiles like Titan, Atlas, Pershing . . . infrared systems . . . spectrometers for planetary and high altitude probes . . . complex telescopes for light-south in Project Stratoscope II.

Electro-Optical Division, Perkin-Elmer Corporation, Norwalk, Connecticut, and Los Angeles, California.

**Perkin-Elmer Corporation**

### Beagle-Auster A.109 Airedale

Specifications	
Type	36 ft. 0 in.
Length	25 ft. 10 in.
Height	9 ft. 2 in.
Wingspan	9 ft. 10 in.
Truck	6 ft. 0 in.
Wing area	314.5 sq. ft.
Tip area	13 sq. ft.
Gross weight	2,790 lb.
Max. wing loading	14.9 lb./sq. ft.
Max. power loading	15.3 lb./sq. ft.
Fuel capacity standard	32 gal.
Fuel capacity long range	72 gal.
Best equipped weight, fuel and oil	3,430 lb.
Disposable load	1,120 lb.
Engine component	5 cu. ft.
Performance	
Max. level speed (sea level)	345 m.p.h. 3,650 ft.
Max. altitude (sea level)	345 m.p.h. 3,650 ft.
Max. maneuver 7,500 ft.	135 m.p.h. 3,650 ft.
Stalling speed flaps up	60 m.p.h. 3,650 ft.
Stalling speed flaps down	52 m.p.h. 3,650 ft.
Turn rate of climb	718 ft./min.
Time to 5,000 ft.	9.5 sec.
Service ceiling	14,900 ft.
Takoff distance to climb 50 ft. at max. power	321 ft.
Takoff distance to climb 50 ft. at max. power	408 ft.
Takoff distance to climb 50 ft. at max. power	505 ft.
Takoff distance to climb 50 ft. at max. power	605 ft.
Landing distance from 10 ft. to rest, still air, standard	421 ft.
Landing distance from 10 ft. to rest, still air, gusty	441 ft.
Ground roll still air, standard	354 ft.
Ground roll still air, gusty	350 ft.
Max. range with standard payload (44 lb.)	450 mi.
Max. range with 700 lb. payload plus 52 gal. fuel and at economy cruise	3,000 mi.
at 155 m.p.h. 3,650 ft. 1,900 ft. no reserves	
Propulsion Licensing C334 A2A, 356 hp.	

London: from London the drive is about 15 miles London Airport (Hathor) has successfully cleared its entrance and will allow multi-engine business planes to land provided the plane has proper radio equipment and the pilot is qualified and licensed for instrument flying. Thus it was again for London Airport to provide VFR landing guidance for lighter aircraft, but this is far as the light.

Association club executive in begin life R. R. Stephens, who and some of the firm will be.

• **Chasing or "keeping open"** outside airports and landing strips for business planes

• **Represent** similar to aircraft authority on questions regarding airport, regulations to restrictions.

• **Increase** and improve various facilities at airports throughout the United Kingdom and "to meet that the port use two-way procedures are increased where an portable run with.

• **Investment** the side, the well worth permanent legislation involving busi-

ness flying and provide flight handling services for members for trips in the U. K.

At Stockholm, U. S. aircraft demonstrated the right display for them, with considerable interest generated by the Paper Craft sportsplane (Viggo Aero Inc. has sold 10 to 100) but the flying drops are more as low take over by the team in the Thorntons Dr. 25 and the Balsa Super Condor. Both planes demonstrated on R100, characteristics, keeping all movement within the Bognor Airport runway length at altitude from 10 to 100 ft.

Only jet entered was the Miles Mustang, which made a short fly. Aside from the Borch Group Pacesetter, others in the light demonstrated were the Borch 1-157 and Borch-Klaxon M2, Borch, Dornier Dr. 27 and 35, Jodel's Ambassador and Mustang, a Lanchester Propeller, Czech Dopravny Aem 101 Metal Solod and Minors and the Italian Propeller P-108 team.

Smaller alone in the show was a Dornier D16, Thakoff's low wing single seater powered by a JAP 1/95 engine.

### Boresight Accuracy

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The effectiveness of the finest roller tracking system can be destroyed by the variation in refraction of the radio beam as it passes through the plane's antenna. The CTA Automatic Bore Sighter Bore Sighter Measuring System corrects for, accurate measurement of the radio beam deflection as a continuous function of the antenna position. Three recorder plot the magnitude of the horizontal and vertical error components, plus the total vector sum of the beam deflection angle, directly in refraction. Rate of change of beam deflection angle, essential to fine control and attitude applications, is readily available from the recordings. Plot error measurement through the refraction is measured and recorded directly. Antenna patterns are plotted with, or without, refraction. This high accuracy automatic boresighting detects discrepancies overlooked by manual methods. The complete expansion is controlled from the master console. The Model 156C, pictured here, is available in two configurations: from 5 through 30, bands and infrared. With five years of world-wide proof of performance, the CTA Automatic Bore Sighter Bore Sighter is available in many of the CTA's advanced leadership in meeting the needs of modern electronics technology.

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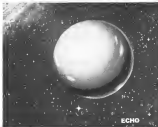
COULIER



DISCOVERER



MIDAS



ECHO

## Philco Achievements in Space Technology

Philco has made many major contributions to the nation's vital space programs. COULIER, the world's first advanced communications satellite, was designed and built by Philco. Philco played a major role in the development and installation of the complex communications, command, tracking and data systems for the DISCOVERER program. Space-borne and ground communications systems for MIDAS and other satellites have been Philco designed. Philco developed and installed the tracking and receiving systems for the Air Force Pioneer Satellite Relay Link, which utilizes

the ECHO satellite. In the field of human factors engineering, Philco has developed personnel subsystems for several major space projects. Philco also produces the world's largest 8-axis satellite tracking antennas.

These achievements are dramatic evidence of Philco's ability to integrate its extensive resources in the design and production of the most sophisticated electronic systems. For capacity, facilities and experience in space technology, look to the leader... look to Philco.

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## Air Taxi Operator Reports Traffic Gains

By Andy Keil

New York—Increased suburban air commuter traffic highlights the growing significance of Air Taxi Co., Red Bank, N. J., as a public factor in that burgeoning market. The company says new traffic trends in volume, origin, service type and passenger turned James Luch, president and chief pilot of Air Taxi Co., reported that total revenue in the first quarter of 1968 were \$17,285, up 51.9% over the same period last year.

Revenue type totaled 1,617, up 19.9% and passenger turned were 1,881, up 17% over 1967's first quarter—despite the heavy snowfall and violent weather experienced during early 1968.

These percentage gains are highlighted against the 14,248 passengers carried to and from airline terminals Oct. 1959–Sept. 1965.

Passenger reasons for the increased traffic are:

- Current trend of industry to move out of congested areas into suburban areas, away from terminal airports.
- Increased business executives demanding less travel time.

“Being in and out of the suburban airports that surround metropolitan New York, air taxis can complete a journey for the suburban passenger in a manner that gives real meaning to transcontinental air speeds,” Luch said.

As a non-scheduled carrier, air taxis operate under Civil Air Regulations 43, but Air Taxi Co.'s shuttle service between La Grange, Illinois, Newark



NORMAL ROUTINE for Air Taxi Co. is the shuttling of critically injured or ill passengers who would find it extremely difficult to travel by other means of transportation.

and Philadelphia airports costs \$15 in a Beech Bonanza at 527 in a two-engine Piper Apache.

Free off-airport traffic Air Taxi Co. has established a routing system extending 275 mi. from the New York area. With the Beech Bonanza a flight with the 25 mi. range would cost \$15. The cost of a flight to the limit of three 275 mi. zone would amount to \$112.75 in the same aircraft. Cost at times of greater distances are estimated individually.

Rates which differ according to the material used, are for the entire airplane, which permits a maximum of 1 passenger in the Bonanza or Apache. Larger aircraft are available to Air Taxi on a lease basis.

Each now owns and operates a fleet of nine planes, six Beech Bonanzas, two Piper Apaches and one Piper Apache. Air Taxi pilots must have a minimum of 1,000 hr. flight time plus a commercial license and instrument rating.

The average time of the 18 pilots now employed is 3,658 hr. with an average of 56 hr.

### Corporate Contract Service

With this fleet of aircraft, Air Taxi Co. also is entering corporate contract service, providing flight service 24 hr. a day, seven days a week, to firms whose executives travel hundreds of miles a year to locations other than those governed by scheduled airlines.

Corporate contract rates will be lower than regular Air Taxi single flight rates and will be based upon a specified number of hours of flight time agreed upon by the subcontractor and the Air Taxi Co. Luch believes the growth level of the corporate contract plan is:

- It is less expensive for a company to make use of Air Taxi than to own and maintain a plane, hire a pilot and pay attendant charges.
- It is less costly to use a small Air Taxi in cases where other than one



### PT6 Installed in Beech 18

PT6 180 hp. turboprop Certified Push & Pull engine has been installed and set in the nose of a modified Beech 18 aircraft by Air Turbine Aircraft Downtown Chertan. Flight test is scheduled at St. Louis, Quebec upon completion of ground test program.



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\*Taken from one of the many case histories in our file... company's name at request.

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All Air Turb aircraft are fully extra-credited for IFR flight, including maximum takeoff, maximum climb rates, climb, cruise and a maximum of 90 channels for communication. Direct radio contact of all times is maintained with the Air Turb base dispatcher as well as with the U. S. Weather Bureau (ATIS).

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Also, in conjunction with the standard aircraft, Air Turb Co. carries a complete part-out inventory of \$100,000.

### Cessna Skybooks Sold Out Until Next Year

Dallas, Tex.—Cessna Skybooks, noting aircraft production currently is sold out for the remainder of this year and part of 1982 under present schedules.

First air stream, which were at the 1981 Air Show, have been of interest to dealers with list of those to be delivered June 1. First commercial production Sky-

book will go to Cessna distributor Larry Hunt, Long Beach, Calif., who is getting a total of six Skybooks. Three dealers and three Skybook, Inc. total customers. Price of base Skybook is \$79,900.

Three of the latest Airway versions are being operated by Helicopters, Inc., Denver, Colo., one carrying, four patrol, power line patrol and mobile site support. Helicopters, Inc., has completed more than 100 for as far as Skybooks.

Cessna is making a nationwide demonstration tour with two Skybooks planning 17 stops on the East and West Coasts, finishing up in the latter part of August. Cessna also is negotiating further approval of schools to train customer and distributor dealer pilots and maintenance personnel, with classes starting Aug. 1. School will utilize a full-time Skybook workshop extensive to detail equipment.

### Cessna Inaugurates Time Payment Plans

New time payment plan preventing purchase of a Cessna 172 for only \$7,100 down as a Model 172 for 1981 down have been inaugurated by Cessna Aircraft Co. Designed to open sales, the new plan will make it possible for potential customers to purchase a new airplane with a down payment totaling only a few hundred dollars more than it costs them to get a private license. Cessna dealers for the past three years have been offering this flight training

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**FAFNIR**  
BALL BEARINGS

## WHO'S WHERE

(Continued from page 28)

### Honors and Elections

**Ret. Adm. James E. Hildard**, Navy Medal of Honor, has been elected president of the American Medical Association. Hildard, 62, is a retired Brig. Gen. (Gen. Hildard, 1950) retired for his services as the Commander of Air Force Systems Command, will take office on April 1, 1962, annual meeting. Other officers: Dr. Charles J. Berton, 1st Vice President; Robert G. Gendy, 2nd Vice President; Col. Spurgeon Neal, USAF, and Dr. M. A. Brown, 3rd Vice President; Dr. M. J. Korman, 4th Vice President; Dr. Neil E. Butler; Dr. James L. Goldfarb and Capt. Frank B. Voss, USN members of the council.

At the American Medical Association's annual meeting included The Times, Dr. C. Lewis Arnold to Air Command; W. C. Stewart, commander of the Royal Air Force Institute of Aviation Medicine; Dr. Raymond P. Longenecker Award to Capt. Philip B. Phillips, Navy Medical Corps; The Arnold D. Varley Award to Lt. Col. Charles A. Boren, USAF Medical Corps; The Joe L. Johnson Award to Capt. Arthur Campbell, Navy Medical Corps; The Louis H. Bacon Award to Lt. Col. Stanley C. White, USAF Medical Corps and Chief of National Aeronautics and Space Administration's Space Task Group; The Warren B. Smith Award to Dr. George J. Korman, USAF Medical Corps; The Walter H. Smith Award to Dr. John E. Smith, USAF Medical Corps.

### Changes

Dr. R. H. Hays, Jr., assistant to the president of Aero-General Corp., Anna D. Hays, Jr. Hays, director of operations, Corp. & Corp. General, Inc. office, has returned to Pasadena, Calif., to be a consulting engineer to Aero-General. Hays, California, replacing Dr. William H. Hays, Jr., director of operations at the General San Diego Division.

Capt. J. Robert North, director of the Naval Ordnance Test Unit at the Naval Air Station, replacing Capt. James G. Fawcett, retiring.

R. Warren Hollander, director of aircraft development, California Division of General Dynamics Corp., San Diego, Calif., replacing J. R. Hays, Jr., retiring.

J. A. Chapman has been assigned to the staff of the new president-elect program Douglas Aircraft Co. Inc. Santa Monica, Calif. Also H. F. Bower program vice president, GAFNIR, Santa Monica, Calif.

Reg. Gen. George W. Goldfarb (USAF), 1st, general manager in the president of the California Aerospace Association, Santa Monica, Calif.

James M. Just, chief engineer, General Dynamics Division of Aero-General Corp. (California, N. J.), appointed and vice president, Robert C. Hollander, engineering administrator, John L. Ciba, design engineering, Charles W. Goldfarb and James J. Ciba, project engineering.



**ASTRONAUTICAL ENGINEERS**... to join a group currently making significant contributions to the national space effort. Studies include design, development, construction, operation, maintenance, and repair of spacecraft, satellites, and other space vehicles. Studies include design, development, construction, operation, maintenance, and repair of spacecraft, satellites, and other space vehicles.

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Machine translation of idioms, for example, is no simple task. A great deal about information processing. An idiomatic phrase may have a meaning quite different from the sum of its individual words, and a system that merely matches these words won't come close to translating it. One solution is an "expanded electronic dictionary" that contains idioms and grammatical instructions as well as single words. Work is now under way to clarify meaning further by automatic syntactical analysis.

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From the same field the berry

*C'est bonnet blanc et blanc bonnet*

It is hat white and white hat

Six of one,  
half a dozen  
of the  
other

Nowhere is this closeness more apparent than at Lockheed. Here, with each passing day, new technological advances help bring closer the exploration of Mars, the Moon and Venus.

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Map by Lockheed from 1961. Approximate distance from Earth to Mars, 22,000,000 miles. Approx. Mars, 5,000 miles from Earth. Photos courtesy of Mission Division and Public Relations Division.





## LETTERS

### Enemy Capabilities

With respect to Mr. John R. Tyler's letter (JAW March 27, p. 134), concerning Gottbrecht's recent economic study, I noted one point that deserves comment:

[illegible]

The lesson to be learned is that the only future posture of a potential opponent at any single point in time can never again be looked at as a static one. If most, if not both the terms of history, be looked at as a boundary phenomenon. This necessitates the need for long range planning for the purpose of anticipating the opponent's future posture and implementing long lead time requirement programs in order to secure or, when a reasonable position where the need becomes critical.

I sincerely hope that My Tyler never has to look down the barrel of a Remington-UMC or SIGM from the desk of his CVA. If he does, I hope he is properly grateful for the admirable minds that will shoot it down and realize that armed law-abiding citizens form the real and powerful such a powerful weapon.

R. S. Cooney

### Restrictive Security

Can't something be done about the inadequate, completely frustrating, and all directing sanctions known as our "no entry system"? Emphasizing the fusion French Revolution death cry "On security, what comes are concentrated in the name."

Verizon can get a rubber stamp reading "Secret" and stamp the Labor House journal and it becomes a classified document, but it requires an approximation of a Constitutional amendment to declassify it. Once declassified, the document must read clearly for 30

**Deflection Week** welcomes the opinions of its readers on the issues raised in all anonymous's editorial columns. Address letters to the Editor, *Deflection Week*, 130 W. 42nd St., New York 36, N. Y. Try to keep letters under 100 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

even though he knows the relationship is actual national security may be at stake is to be inconsistent.

Why not date the classification on a document and make it automatically declassified at the end of a year or two or so? Also, some type of government seal or imprint should be required to make the classification valid.

[illegible]

I use this to show how our present system provides a beautiful shield for newspapers and ourselves (y both being) and in what ways the domestic nation is to be

Our approach to access should be on the basis of a calculated risk. It is doubtful as to whether a document should be classified

day? It would hang on almost as much as the Romans. With those admitted ahead of us in some important fields, some red would be in order to establish our own share as we can start coming again.

A short time back a young engineer used to work for me. He told me that when he first went to work, his previous employer had invented a new type *studs needed valve* for a cruise rocket. The initial layouts were submitted for approval and promptly stamped *Secret*. It was three days before he could pass access to his own work, because he only had an interim "Confidential" clearance.

The "need to know" philosophy is another report of security as a need of revision if we want to get back into high gear. Excess

engineer and scientist with his salt is "knowledge hungry." *Free in World War II* we realize they shared in our profession of awe even! Many of us carried little black books of technical notes passed without any "good to know" because someone there might be useful. Sometimes the best solution to a problem comes from an other overlooked field of which there is no manual "need to know."

"We could have it: a perfect security system would guarantee absolute anonymity in the vote; no one, and would maintain a stagnant status quo of scientific knowledge. While we are not quite beyond this, it is becoming apparent why the Romans got ahead of us. Nearly all progress today is on the basis of the security system, and on any more rapid progress waits—not maintaining a fixed position.

Impoverishing society meetings that 18 years ago were live lessons of current knowledge have degenerated to numerous retakes of old stuff read on month's ago in Arsonist Week. Of course, some of the secret services are good if you know three months ahead that you could get away and get your "chance" in the arena will be here.

Who can't do chemistry is up to individual rather than a company build. A disease and social economy, one might be confused with mental growth and picture with only two levels of education, "classical" or "not classical," these men to be included at specified intervals (one year—two years—?) on the individual's responsibility—like a doctor's license. Thus to attend classical means that his single parent has discovered and he can't do it, but neither is a company's responsibility. The company was told to attend but has no one to attend in single by way in, whereas the engineer who should go gets so bogged down at various patches (which are thereby changed) that he gives up in despair.

The letters can be easily pooled and deposited as propaganda by those who don't substantiate or are interested in maintaining an outdated status quo, but the facts remain true not for those who must work under the system. Since some reform is necessary isn't it best streamlined and get it off our backs so we can move ahead quickly?

As Our Times  
Gilden

## Overheard?

In regard to the last story on your "The daily Observer" column, May 1 issue (p. 21), I believe the USAF search effort has had an egg.

I would think that life research is necessary to determine there is nothing unusual

**Robert C. Termer**  
Bethesda, MD

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